John Warburton

MEDICAL EXTRACTS.

ON THE
NATURE OF HEALTH,
AND
THE LAWS
OF THE
NERVOUS AND FIBROUS SYSTEMS.
WITH
PRACTICAL OBSERVATIONS:

BY

A FRIEND TO IMPROVEMENTS. [Robt. John Thornton]

VOL. II.

THE THIRD EDITION.

> Homines ad deos in nullâ re propius accedunt, quam *ſalutem* hominibus dando.
>
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1798.

TO

DR. DARWIN.

PHYSICIANS often lament, that their patients will not purſue the directions given them; and indeed, when their ſenſe is not perſuaded, it is no wonder they are tempted to follow their own fancies. It is preſumed, that thoſe, who will be at the trouble to peruſe the following pages, will ſee abundant reaſon for the injunctions frequently given them by ſcientific practitioners, reſpecting *food*, *air*, *exerciſe*, *diverſions*, &c. &c. and having acquired a knowledge of THE NATURE OF HEALTH, and THE LAWS OF THE ANIMAL OECONOMY, they will alſo be able to diſtinguiſh the Practitioner of *modeſt merit* from the *Quack*, who wades in darkneſs, and tries his *ſpecific remedies* one after another, until the patient recovers more by accident, and the efforts of Nature, than any thing elſe, or can tell no tales. This part of the work, I am led to think, will be alſo amuſing to the philoſopher, who conſiders the ſtudy of the human frame a part, and the moſt intereſting part, of natural hiſtory. It may prepare the ſtudent for the more careful ſtudy of your incomparable work *, which, had it appeared ſooner, would have earlier enriched this volume, and the diſcoveries of Dr. JOHN BROWN would have been *alſo* attributed to you, as they were made *previous* to his, though not publiſhed to the world, as many of your friends can atteſt.

I HAVE THE HONOUR TO BE,

WITH THE HIGHEST RESPECT AND ESTEEM,

&c. &c.

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* *Zoonomia*, or *the Laws of Organic Life.* Two Vols. Quarto.

It is truly mortifying to obſerve the *ſlow progreſs* of IMPROVEMENTS, and to hear the *abſurd objections* made to them, and that not unfrequently by people of the beſt ſenſe and education. His *late Majeſty* wiſhed to have the ſtreets of London and Westminster paved in the *preſent way*; but on adviſing with ſome Scotch phyſicians, they ſaid it would be very hurtful to the health of his *Majeſty*'s good citizens of London, who had little time to ſpare for the taking of exerciſe, and that the jolting of a coach for one mile over the ſtones did more ſervice than the travelling of ſeveral miles on a better road. His *Majeſty* had too great a regard for his people to countenance any thing that would injure their health, and ſo it was dropt.—However ſeveral Londoners, who had been witneſs to the ſuperiority of the ſtreets in Edinburgh, were reſolved about thirty years back to make the trial; and, I am creditably informed, that *York* and *St. James*'s were the firſt ſtreets that were paved in the NEW WAY, and the *mob* were ſo diſpleaſed, that what was laid down in the *day* they pulled up in the *night*. Amongſt other objections, they ſaid the ſtones were ſo ſmall they could not bear the weight of the carriages, and ſo ſmooth the horſes could have no footing, and that trade would be ruined. It was in vain to tell them, that the city of Edinburgh had been paved in that manner near an hundred years back. The night-watchmen, however, being increaſed, and this trial ſucceeding, it became univerſal, and many other cities and towns adopted it, and I believe nothing now would induce them to ſubmit to have the ſtreets paved in the OLD WAY. In Russia, prejudice is ſo ſtrong, that, though large premiums have been offered to the carpenters, the SAW has not *as yet* been able to be *introduced!*——Donaldson. Cox.

PART III.

THE
NATURE OF HEALTH:
AND
THE LAWS
OF THE
FIBROUS SYSTEM.

An Extract from Dr. LETTSOM's Oration, when preſenting the *Prize Medal*,
Adjudged to Dr. FOTHERGILL of BATH,

FOR HIS DISSERTATION ON THE EFFICACY OF VITAL AIR IN THE RESTORATION OF SUSPENDED ANIMATION.

A long ſeries of years is often required for the admiſſion of NEW TRUTHS. It was thought audacity in M. FAGON to defend the *Harveian Diſcovery*, near forty years after the firſt promulgation of it in England. So COLUMBUS, when he firſt divulged his vaſt project of *doubling the globe*, was inſulted by INCREDULITY; and, after he had added a *new* to the *old hemiſphere*, was perſecuted by ENVY. In like manner, when the northern Luminary, LINNÆUS, created a *new ſyſtem* of vegetable nature, he found on every ſide *determined aſſailants*; but, fortified by the energies of his capacious mind, he gave this reply,

"POSTERITY WILL DECIDE;"

and, pointing to ſome academic children at play—"*Theſe*," added he, "*will become our judges.*"

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In like Manner the Science of *Chemiſtry* has had its Revolutions, and one Error ſucceeded to another, until **Lavoisier** eſtabliſhed a *Syſtem*, which being founded upon *Truth*, is *eternal*, - - - - - - iv

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After *ſeven Days,* a ſlight *Solution* of the Meat appeared in *both Phials*; but in the
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1ſt Phial, after *two Days,* the SOLUTION was rather *greater* than in the 1ſt Experiment, and the *Fœtor* was *very great:* Whereas in the
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2d. *Experiment* with a Dog.
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3d. A GENIAL and EXTENSIVE WARMTH.

4th. A GREATER FLOW of SPIRITS than uſual.

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2d. Nearly *two Thirds* of the *Poor*, born in THIS ISLAND, *periſh* in *their Infancy*, - - - - - - - - - - - ib.

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1ſt. It is 2 *Parts* FIXED AIR.

2d. ——1 *Part* AZOTIC AIR.

3d. ——-—— WATER, impregnated with SALINE, and OTHER MATTERS.

The *Abſorbents* of the Skin imbibe OXYGEN, or VITAL, AIR, even *ſeparating it* from *atmoſpheric Air.*

Does the *ſame Analogy* hold with regard to THE LUNGS?

This Queſtion will be attempted to be *anſwered* by Experiments inſtituted by Dr. BEDDOES and Dr. THORNTON, - - - - - ib.

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Of the PUPIL, - - - - - - - - - - - ib.

Of the IRIS or UVIA, and *its Action,* - - ib.

THE FIBROUS TEXTURE of *this Part* of the Eye *demonſtrated* by Dr. HAIGHTON.

ITS SYMPATHY with *the Optic Nerve.*

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The *Impreſſion* cannot *ariſe* from VIBRATION, or the MOTION of an INERT FLUID, - - 281

It muſt *ariſe* therefore from ſome SUBTLE AGENT, and the *Inſtantaneouſneſs* of the *Propagation* of *ſenſible Impreſſions* and *muſcular Motion* indicates *an Analogy* between THIS FLUID and the ELECTRIC FLUID, - ib.

A *Sixth Part* of the *Blood* goes to the Brain OXYGENATED and returns thence UN-OXYGENATED, and it is *inferred* that the *Brain* converts the *diſengaged Caloric* into the *electric Fluid*, - - - - - - - - - - - 282

The MIND is *ſeated* in the *Brain*, - - - - ib.

The *Reflection* which *this Idea* naturally ſuggeſts, - - - - - - - - - - - - - ib.

SECT. XV. OF HEARING.

The EXTERNAL EAR, - - - - - - - - 283

The CANAL or PASSAGE leading to the *internal Ear*, - - - - - - - - - - - ib.

The WAX is deſigned as a *defence* of *this Part*, - - - - - - - - - - - - ib.

At the *Extremity* of this *Canal* is A MEMBRANE dividing the *external* from the *internal Ear*, - - - - - - - - - - - 284

The *Structure* of the *internal Ear*.

1. The TYMPANUM OR DRUM, - - - ib.

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From *this Part* there is an *opening* called the EUSTACHEAN TUBE, - - - - - - - 284

Its *Office*, - - - - - - - - - - - - ib.

This Tube is *cloſed*, when we are in the act of ſwallowing, by the UVULA, which alſo prevents the Food from paſſing into the Noſe.
The *merciful Wiſdom* of PROVIDENCE is conſpicuous in this Inſtance, as *Brutes*, who are prone, and therefore not ſubject to have any of their Aliment paſs through the Noſe, want *this Defence*, - - - - - - - - - ib.

Within the *Tympanum* or *Drum* there are

2. FOUR SMALL BONES.

Theſe *communicate* with,

3. THREE BONY and WINDING CAVITIES, lined in the Inſide with,
4. NERVOUS FILAMENTS, which unite into a common Trunk, and go to the Brain.

The *Tympanum* and *its four Bones* ſuppoſed to be the immediate Organs of hearing, - 285

Theſe Parts, like the *Humours* of the Eye, only *prepare* the Object for the immediate Organ, - - - - - - - - - - - - 286

The *benevolent Intention* of the ALMIGHTY ſhewn by the *Difference* in the Structure of *the Membranes* of the *Drum* in *Birds* and in *Animals*, - - - - - - - - 285

This Membrane was *removed* from the Ears of a Dog, and his Hearing was not in conſequence *deſtroyed*, - - - ib.

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As *a Defect* in *this Part* of the Ear may be *reaſonably preſumed* to be *a Cauſe* of *Deafneſs*, CHESELDEN propoſed to *extract it*, for the ſame Reaſon as the *chryſtalline Lens* when in a State of Diſeaſe is *extracted* and *Sight* is reſtored.

A *Malefactor*, who was *deaf*, receives his Pardon on condition he ſubmits to this Operation.

As ſoon as this was publicly known, THIS EMINENT ANATOMIST is *inſulted* in the Streets, and having entered the Theatre, the Play is ſtopt by the Cry of *Drum! Drum!* and he is conſtrained by the public voice to give up the Experiment.

Such has ever been the Treatment of Men, who, from Benevolence of Heart, and a philoſophic Conviction of Truth, attempt to innovate, or rather it ſhould be ſaid, to improve on the Routine of Things, - - - - - - - - 286

The *Ear* has WATER confined within it, which, as being a *denſer Fluid* than *Air*, is better adapted to the Propagation of *Vibrations*, - - - - - - - - - - - - ib.

A *curious Diſtribution* of the *Nerves* which *occaſions* an *uſeful Conſent* of Parts, - - - 287

OTHER ASSOCIATIONS exiſt which cannot be *referred* to the *Nerves*, - - - - - - - - - - - - - - ib.

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In *Animals* HEARING *forewarns* them of *Dangers*, in *Man* it is an *Inlet* to a *Variety* of *Pleaſures*, - - - - - - - - - - - 288

Of the young Man who was born *deaf* and *recovered* his *Hearing* when he was *twenty-four Years old*, and *an Account* of his *State of Mind* during *this Period*, - - - - ib.

All Nations have *their Muſic*, - - - - - - 289

Loud *Sounds* powerfully *operate* on the *Spirits*, 290

SECT. XVI. OF THE TOUCH.

The *Surface of the Body* the *Seat* of THIS SENSE, - - - - - - - - - - - - - 291

The *Skin* is an *Emunctory* to ſend out the effete Parts of the Blood, and is therefore covered with INNUMERABLE PORES, - - ib.

It is compoſed of *two Parts*,

1ſt. THE EXTERNAL SKIN,

2d. THE INTERNAL SKIN.

Between *theſe* is placed a MUCOUS SUBSTANCE called RETE MUCOSUM, *(the Mucous Net)*, being *pierced throughout* by NERVOUS PAPILLÆ, - - - - - - - 192

This Subſtance gives *colour* to the Body, and forms the *chief Contraſt* betwixt *black* and *white Men*.

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Dr. Beddoes, by a chemical Proceſs, converted the *black* Skin of a Negro into *white*; and it is ſaid that the *Reverſe* happened to a reverend Divine in France, - - 292

The nervous Papillæ ariſe from the *external* Skin, and *every where pierce* the *mucous Subſtance*, - - - - - - - - - ib.

These Papillæ, beſides *their Senſe* of *Pain*, poſſeſs the peculiar Power of conveying to the Mind the Impreſſion of *Hardneſs* and *Softneſs*, - - - - - - - - - - ib.

By the Touch we *correct* the *Errors* of *Viſion*, - - - - - - - - - - ib.

This is illuſtrated,

1ſt. By the *Miſtakes* of *Infants*.

2d. By the *firſt Actions* of the Boy who was *couched* for Blindneſs at the Age of Thirteen.

3d. By *Obſervations* on *Animals*, - - 293

Brutes are *intelligent* in proportion to the *Accuracy* of *their Feeling*, - - - - - - ib.

This Sense is the *peculiar Amuſement* of *Infants*, - - - - - - - - - - ib.

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Pains are exceedingly *various* though claſſed under the ſame general Head, - - - - 294

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SICKNESS ariſes not from the *Stimulus* of an Emetic, but from *a Senſation* in the Stomach, very diſtinct from that of Pain, - - - - - - - - - - - - - - - 294

This *Diverſity* in the *Senſations* of PAIN does not proceed from a *Change* of *Structure* in *the Nerves*; but from the *Difference* of the *Organization* of Parts through which they ſhoot, and of the *Stimuli applied*, - - - - - 295

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The *Analogy* that exiſts between HEAT and the ELECTRIC FLUID, - - - - - - - 296

The *Neceſſity* of a *due Degree* of VITAL HEAT to the *animal Œconomy*, - - - - - - 297

It is *conjectured* that *the Senſe* of *Touch* ariſes from a *diſtinct* Set of Nerves, as diſtinct as the Nerves of the other Senſes.

It is likewiſe *conjectured* that the *Senſation* of *Heat* is conveyed by a *diſtinct* and appropriated Set of Nerves, - - - - - - - ib.

A Note recommending this to the Conſideration of Anatomiſts, and referring them to what was ſaid in Section XXXI. ON THE SENTIENT PRINCIPLE, *when the Differences in Perception were ſaid to ariſe wholly from Organization*, - - - - - - - - - - - - - - ib.

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The TEETH have the *Perceptions* of HEAT and COLD, although they are the *leaſt adapted* for the *Perceptions* of *Solidity* and *Figure*, - 297

An Extract from a Letter of Dr. DARWIN, when a Student at *Edinburgh*, to his Father Dr. DARWIN of *Derby*, in which he relates an *Experiment* made by him and Dr. EWART, with a patient in the Hoſpital, to aſcertain, *whether* the *Nerves*, when *inſenſible* to *Pain*, have the *Perception* of HEAT, - - - - - - - - - - - 298

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The CHIEF OFFICE of *Smelling*, - - - - - 300

The *Deſign* of *this Senſe* is *perverted* by *our Mode* of *Living*, - - - - - - - - - - ib.

The *benevolent Intention* of the CREATOR ſhewn, in placing the Senſes of SEEING, SMELLING, and TASTING, ſo *contiguous* to *each other*, - - - - - - - - - - - ib.

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This is *inſtanced* by our *Swallowing nauſeous Medicines* without *hardly taſting them,* when *the Noſe is confined,* - - - - - - - - ib.

The PAPILLÆ of the *Tongue,* and *their Uſe,* - ib.

The *Manner* in which the *Saliva* aſſiſts the *Senſe* of *Taſte,* - - - - - - - - - 303

ANIMALS determine *their Food* by the *Smell,* and then the *Taſte,* and are led each to his *proper Nouriſhment* by his Organs of Senſe, ib.

The RELISH for *different Kinds* of *Food* is adapted to the TEMPERAMENTS or STATES of THE FIBRE, - - - - - - - - - 304

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The *wider the Sphere,* the more capable is *the Senſe* of making *Combinations.*

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The MAN of IMAGINATION makes a *great* and an *artificial Happineſs,* by the *Pleaſure* of *altering* and *combining,* - - - - - ib.

The SENSUALIST juſt *ſtops* where he *began,* and has only *ſuch Pleaſures* as are *made* to *his Hand,* - - - - - - - - - - - - ib.

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ANGER, in its Operation on the animal Œconomy, is one of the *ſtrongeſt* of the *mental Stimuli,* - - - - - - - - - - - 307

This *Stimulus* is *uſually too active* in its Operation to be friendly to Health, - - - - 307

When *Revenge* cannot be *indulged* the Countenance turns *pale,* - - - - - - - - ib.

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A very *ſtriking Example* of this obſerved in the BRITISH FLEET in the Year 1744, - 307

Alſo in the AMERICAN ARMY in the Year 1776, - - - - - - - - - - - - - - 308

On this ſame Principle it is that *Savages,* to ſatiate their Revenge, bear, with uncommon Patience and without Injury, all the Severities of Cold and Hunger, - - - 310

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This is the *mildeſt* and *moſt agreeable* of the *mental Stimuli,* - - - - - - - - - - 312

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Of the MIRACULOUS CURES wrought *by viſiting the Tomb* of the Abbé PARIS, - - - 315

The *Jeſuits*, with the *Civil Power*, endeavour to *refute* and *detect* THESE MIRACULOUS CURES, - - - - - - - - - - - ib.

In a Note. An Account of *theſe Cures* in two Works, - ib.

They were many of them *proved* immediately by *Witneſſes* before the BISHOP'S COURT at *Paris*, in the Preſence of Cardinal NOAILLES, - - - - - - - - - 316

His Succeſſor in the Archbiſhopric was preſſed by *twenty-two Rectors* of *Paris* alſo to examine into them; but he prudently forbore making the Enquiry, - - - - - ib.

One hundred and *twenty Witneſſes*, moſt of them Perſons of Credit and Subſtance in *Paris*, gave oath for *one Miracle*, the Cure of Madamoiſelle LE FRANC, - - - ib.

A *ſolemn*

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Monſ. HERAULT, *Lieutenant de Police*, frequently *ſeized immediately* and *examined* the *Witneſſes* and *Subjects* of theſe Miracles; but never could reach any Thing ſatiſfactory *againſt* them, - - - - - - - - - - - - ib.

The *Opinion* of the D. SYLVA, Phyſician, in the Caſe of Madamoiſelle THIBAUT, - - - - - - - - - ib.

The Duc de CHATILLON, a Perſon of the higheſt Rank and Family, gives evidence of a *Cure* performed on a Servant of his, who had lived ſeveral Years in his Houſe with a *viſible* and *palpable Infirmity*, - - - - - - 317

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THIS CURE is *corroborated* by the Evidence of a Multitude of *Nuns, Prieſts, Phyſicians*, and *Men of the World*, and all of them Perſons of undoubted Credit, - - - - ib.

The QUEEN-REGENT of *France* ſent *her own Phyſician* to examine into THIS SUPPOSED MIRACLE, and he returns *an abſolute Convert*.

Had all this been *a Cheat*, it had moſt certainly, ſays the celebrated Hiſtorian HUME, been *detected* by ſuch *ſagacious* and *powerful Antagoniſts*.

If we *credit theſe Cures*, we can with propriety *attribute them only* to the *powerful Influence* of HOPE on the *human Frame*, - - - - ib.

A *ſtriking Example* of the *Influence* of the *Mind* on *Diſorders* of the *Body* exhibited at the Siege of BREDA, - - - - - - - - ib.

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The *Diſtreſs* was ſo great from the SCURVY, that the *Garriſon* had Intentions of *Surrendering that City*, - - - - - - - - 318

To prevent *which*, the PRINCE of ORANGE had recourſe to the Expedient of ſending a MEDICINE to the ARMY, ſaid to be of *great Price, three Drops* of which was to impart a *healing Virtue* to a Gallon of Water.

Each Phyſician was intruſted with only *three ſmall Phials* of this MEDICINE, - - - ib.

Even the Commanders were not let into *the Secret* of the Cheat upon the Soldiers, - ib.

The EFFECT of *this Deluſion* was *truly aſtoniſhing*; for *many* were *quickly* and *perfectly recovered. Such as had not moved their Limbs* for a Month before, were in a few Days ſeen walking the Streets with *their Limbs ſound, ſtraight,* and *whole*, - - - - - 319

Even *the Belly* now of itſelf *performed its Office*, or at leaſt with ſmall Aſſiſtance of Medicine, - - - - - - - - - - - - ib.

Many, who had declared that they had been rendered *worſe* by all former Remedies, *recovered* in a few Days, to their inexpreſſible Joy, and the no leſs general Surpriſe, by their taking THEIR GRACIOUS PRINCE'S CURE, - ib.

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The *Attention* of the *Mind* being occupied by *ſome intereſting Object,* exciting FEAR, has *removed many Diſorders,* - - - - - - 321

A Mother, who has ſeldom enjoyed a Day's Health, has been *free* from all Complaint *during the Illneſs of a favourite Child,* and has *relapſed* as ſoon as *this has recovered,* - ib.

During the TROUBLES in *Scotland, hyſterical* and *nervous Diſorders* univerſally *diſappeared,* - - - - - - - - - - - - - 322

A very *remarkable Inſtance* of the Powers of Mind in the *Production* and *Removal* of EPILEPSY, - - - - - - - - - - - ib.

BOERHAAVE's *judicious Conduct,* - - - - ib.

An *Inſtance* of a *Paroxyſm* of ASTHMA removed by a *ſudden Alarm,* - - - - - 323

SECT. XXIX. OF HABIT.

A Propenſity to acquire *Habits* is a general Law of the animal Œconomy, - - - 324

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This is illuſtrated by the Difference in the *Savage,* and the *Man* in *civilized Life;* who is in *the Habit* of EATING and SLEEPING at a certain Hour, - - - - - - - - - 324

The ſame holds with reſpect to EVACUATIONS, - - - - - - - - - - - - 325

From *this Law, the Advantage* produced by Bark, Steel, &c. is kept up, for the *increaſed Action* from theſe Remedies becomes a *Link* in *the Chain* of Action, and when the Time returns for *this increaſed additional Movement,* though the impulſe be diſcontinued, the Motion from *Habit* remains, - - - - - - - - - - - - 326

This is illuſtrated by *ſeveral Examples,* - - ib.

Beſides, during the *Interval* of increaſed Action, THE DISEASE is oftentimes *removed,* and when the Bark, &c. are left off, it does not recur,—becauſe HEALTH is the *natural State* of the *animal Œconomy,* - ib.

ASSOCIATED MOTIONS are of two Kinds,

1. *Voluntary,*

2. *Involuntary,* - - - - - - - - 327

The *Force* of HABIT illuſtrated in *Animals,*

1ſt. The Horſe has his *accuſtomed Paces,*

2d. He always knows *his way home,* - ib.

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All Animals have their HAUNTS, - - - - 328

Their firſt Object is *the Choice* of FOOD, the Second a *ſafe Place* to SLEEP IN, - - - ib.

When Animals paſs from their Place of *reſt* in ſearch of *Food,* the Choice of a PATH is the Reſult of *Habit,* - - - - - - ib.

Hares, Sheep, Horſes, &c. have each their TRACK, - - - - - - - - - - - - 329

If a *drunken Man* ſhould happen to paſs the Firſt over a *ploughed Field,* it is obſerved that *his after Followers* each fall into the ſame *Track,* and the *Path* is ever after *crooked,* - - - - - - - - - - - ib.

In large Companies, each Perſon at a public Table drops into the *ſame Seat* he had occupied the Day before, - - - - - - ib.

In a Farmer's Stable, his Horſes and Cows pertinaciouſly retain each one its *peculiar Place,* - - - - - - - - - - - - - ib.

In their *Friendſhips* Animals are governed by the Force of *Habit,* - - - - - - - - ib.

A ſtriking *Example* of *this,* - - - - - 330

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On *this Principle* NATURE accommodates herſelf to *Diſeaſe,* and even feels *burthened* and *oppreſſed* when Diſorders that have become HABITUAL are removed, - - - - 330

From the *Power* of HABIT (which depends upon ſuch *nice Circumſtances,* as to eſcape, as yet, the Ken of Philoſophy), when *one Kind* of *Stimulus* ceaſes to rouſe the Fibre into the neceſſary Quantity of Action, it is often ſufficient to produce the deſired Effect to *change* the *Stimulus* for another *apparently ſimilar* in *Quantity* and *Quality,* ib.

This is agreeably illuſtrated by Dr. DARWIN, - - - - - - - - - - - - - ib.

Other Examples of the *Effects* of a SUCCESSION of *Stimuli,* - - - - - - 331 and 332

The ſame *general Law* applies in the EXHIBITION of *Medicine,* - - - - - - - 333

AN EXCEPTION TO THIS INFLUENCE OF HABIT.

When the firſt *Impreſſion,* however, is *very ſtrong,* and the *Effect* produced *very violent,* a *Force* INFERIOR to the *original one* will produce the *ſame Effect,* - - - - ib.

Examples to illuſtrate this, - - - - - ib.

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An *Attempt* towards an EXPLANATION of *this perplexing Phænomenon,* - - - - - - - 334

1ſt. From the *Chain* of ASSOCIATED ACTIONS being *interrupted.*

A Note would have been inſerted here to refer the Reader to what was ſaid Page 325, Line 22, had this Page allowed of it.

2d. From a CHANGE wrought on *the Fibre.*

The Reader alſo would have been requeſted to reconſider what was ſaid page 325, Line 8.

Matter preliminary to the Explanation of the Firſt Law of the Nervous and Fibrous Syſtems.

THE

PROGRESS OF MEDICINE.

> "If I had foreſeen all the weight of *oppoſition* that has ariſen againſt me, I would have left to others the purſuit of an empty ſhadow—but the reflection of being of ſervice to my fellow creatures affords a return for the inquietudes ever attendant upon literary exertions." Vide Sir ISAAC NEWTON's Letter to Dr. Bentley.

As long as PHILOSOPHY was built, not upon the ſubſtantial baſis of actual experiment, but imagined properties, which were aſſumed as data, it was putting on new forms almoſt every day; for one fanciful opinion had always a right to ſupplant another. Hence the beſt PHILOSOPHER in thoſe days was him who could reaſon moſt ingeniouſly on occult qualities, either invented by himſelf, or by ſome favourite writer.

Lord Chancellor BACON was the firſt who diſcovered the fallacy of this ſort of philoſophy. He rejected all that chimerical nonſenſe, which had uſurped the name of philoſophy, and wiſely exclaimed—"Non fingendum, "aut excogitandum, quid Natura feret et faciat, ſed inveniendum eſt." That the operations of nature was not be fancied, but diligently ſcrutinized. Hence, in leſs than the ſpace of a century, the principle of philoſophizing being altered, more light was thrown upon every branch of ſcience, than it had received for above two thouſand years before.

The diſcovery of the *circulation of the blood* firſt immortalized the name of HARVEY. It may appear wonderful, and at the ſame time not a little mortifying to the vanity of mankind, that a motion in the frame, which conſtitutes the baſis of life, and which chance muſt have made us ſenſible of a thouſand times, ſhould have eſcaped the eyes of all who imagined themſelves to be obſervers, and ſome of whom were actually ſuch. When the doctrine of the circulation of the blood could no longer be reſiſted, various unſucceſsful attempts were then made to prove that it was known long before; ſo was it with COLUMBUS who diſcovered a new world, which occaſioned him to make this ſimple propoſal to his oppoſers, namely, "*to place an egg upright.*" All attempted, but in vain. This illuſtrious navigator then *himſelf* broke the end, and "*the egg ſtood up.*"

"*The thing*," ſays he, "*is very eaſy when known*," and ENVY itſelf was abaſhed. Thus attraction, the weight, and elaſticity of the air, ſhewed themſelves to the ſenſes every day; but it required a TORRICELLI and a NEWTON to illuſtrate them.

The diſcovery of the next importance is *irritability*, a property eſſential to all animals, likewiſe to all plants, and which henceforth will juſtly be ranked amongſt the principal qualities of all organized animated beings. This diſcovery confirms the more honour on Baron de HALLER, as it was made in an enlightened period, and upon a ſubject ſo much ſearched after as the human body. This diſcovery alſo, like the other, met at firſt with violent oppoſition, and from ſimilar motives: INDOLENCE, to avoid the trouble of an examination; VANITY, to ſhun the imputation of ignorance; and ENVY, to deprive the diſcoverer of his praiſe. Hence its exiſtence was firſt flatly denied; and after it was confirmed by the ſtrongeſt facts, ſo that it was impoſſible for the moſt ſtubborn prepoſſeſſion to challenge the truth of it, the merit of the diſcovery was then attempted to be wreſted from the author.

In like manner the ſcience of *chemiſtry* has had its revolutions, and one error ſucceeded to another until LAVOISIER

VOISIER eſtabliſhed a ſyſtem, which being founded upon *truth* is *eternal*.

Upon the broad baſis of *the diſcovery* of HALLER[*], and the *new chemiſtry* of LAVOISIER,—Dr. BEDDOES,—Dr. DARWIN,—and the Rev. Mr. TOWNSEND[†], have raiſed a *new* and beautiful *ſuperſtructure*, ſuch as we ſhall endeavour to deſcribe in this work, and it is hoped that ſoon, inſtead of a proverbial *diſagreement*, the *ſame conſent* among *practitioners* will be eſtabliſhed as at preſent exiſts among *aſtronomers* and *chemiſts*.

But to return to the object of this work

DEF. I.

Baron de HALLER calls that a SENSIBLE PART of the human body, which, upon being hurt tranſmits the impreſſion to the ſoul; or which, in other words, occaſions evident ſigns of pain and diſquiet in the animal.

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[*] Dr. BROWN appears by his writings to have been the firſt who formed *a ſyſtem of Phyſic* on the *irritability* of the Fibre; this ſyſtem, vulgerly called the BRUNONIAN SYSTEM, AS IMPROVED BY THE NEW DISCOVERIES IN CHEMISTRY, is the object of the preſent work.

[†] It is to the writings of theſe gentlemen that the Author of MEDICAL EXTRACTS owes his chief obligations. Other works, however, have been conſulted, and in the illuſtration of this *new Syſtem*, it is attempted, as much as poſſible, to obtain the voice of every one,

DELECTANDO pariterque MONENDO.——
HOR.

DEF. II.

On the contrary, he calls that INSENSIBLE, which being burnt, tore, pricked, or cut till it is quite deſtroyed, occaſions no ſign of pain or convulſion, nor any ſort of change in the ſituation of the body:

DEF. III.

And he calls that an IRRITABLE PART, which becomes ſhorter upon being touched; very irritable if it contracts upon a ſlight touch, and the contrary, if by a violent touch it contracts but little.

We have therefore a *threefold diviſion* of the human body into PARTS,

1. SENSIBLE;
2. INSENSIBLE; and
3. IRRITABLE.

FABLES relate that VENUS was wedded to VULCAN, the Goddeſs of beauty to the God of deformity. The tale, as ſome explain it, gives a double repreſentation of art; VULCAN ſhewing us the *progreſſions* of art, and VENUS the *completion.* The *progreſſions,* ſuch as the hewing of ſtone, the grinding of colours, the fuſion of metals, theſe all of them are laborious, and many times diſguſtful: the *completions,* ſuch as the temple, the palace, the picture, the ſtatue, theſe all of them are beauties, and juſtly call for admiration. Now if *Anatomy* and *Phyſiology* be arts not ending in themſelves, but have a view to ſomething farther, they muſt neceſſarily be arts of the *progreſſive character.* If then, in treating on them, the ſubject ſhould appear *dry* rather than *elegant,* *ſevere* rather than *pleaſing,* let it plead, by way of defence, that, though its importance may be great, it partakes from its very nature, which cannot be changed, more of the *deformed God,* than of the *beautiful Goddeſs.*

HARRIS.

THE APOLOGY.

It is with ſome reluctance that I preſent to the humane Reader this uſeful detail of experiments on animals, though I think a better apology may be given for theſe, than for the *diverſions* of hunting, fiſhing, and ſhooting, which are univerſally tolerated in civilized ſocieties:—and, perhaps, the compaſſionate Reader, like thoſe who do not object to the enjoyment of the fruits of theſe ſports and paſtimes, as they are improperly called, ſo may he peruſe with ſome pleaſure the concluſions drawn from the ſufferings of nature, inflicted by man on animals, from the more *exalted motive* of *philanthrophy*.

IRRITABILITY is one of thoſe grand truths which is undeniably demonſtrated; and *Poſterity*, which alone ſtamps the merit of diſcoveries, *by abſtracting of perſons*, will promote *this diſcovery* to that rank, which its USEFULNESS intitles it to. She will laugh when ſhe obſerves, that after its opposers had failed in perſuading us there was *no ſuch thing*, they ſhould endeavour to render the doctrine *odious*, by the conſequence which they pretend naturally follows from it. She will be diverted to ſee Phyſicians following the example of religious Sectaries and Devotees, intereſting the cauſe of GOD with *theirs*, and accuſing of MATERIALISM, ſuch as differ from them in opinion as to the pulſations of the Heart, and motion of the other organs. A certain author, well known for the greatneſs of his talents, and the bad uſe which he made of them, has endeavoured to draw *this induction*; but the illuſtrious De HALLER, who was ſeriouſly affected at the imputation, has ably refuted the futility of ſuch impious and abſurd reaſoning.

TISSOT.

I. OF IRRITABLE PARTS.

The Heart.

It is obſervable, that the motion of the HEART* not only ſurvives that of the organs of voluntary motion, but continues a conſiderable time even after it is ſeparated from the body. Nay, after it has even ceaſed to palpitate, yet as it ſtill retains a latent power of contraction, its ſyſtole and diaſtole may, by the application of ſtimuli, be alternately renewed and continued ſome time longer. Hence in drowning or ſuffocation, though the pulſe be imperceptible, and life apparently extinguiſhed, yet the heart ſtill preſerves this latent power or ſuſceptibility of motion; for though unable to propel the blood through the vaſcular ſyſtem, yet it wants only to be gently excited by ſuitable ſtimuli to renew its action.

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* Vide Numbers I. and II. of the Plates of the HEART; of the natural Size, to ſhew the Circulation and the Effect of Vital Air on the Blood. Printed for Johnſon, St. Paul's Church-yard; and Robinſons, Paternoſter-Row. Price 7*s.* 6*d.*

Plates alſo of all the internal viſcera of the human body, of the natural ſize, will be printed in colours, to illuſtrate this work, if the public, anxious to know of what parts they are compoſed, give this undertaking (a ſpecimen of which has been already exhibited) the encouragement which it ſeems to merit.

In the firſt rudiments of animal life, even before the brain is formed, the PUNCTUM SALIENS points out the embrio heart in miniature, and marks its *primæval irritability* as a ſure preſage of vitality.

The heart of the chick begins to move, before we dare preſume, that there is any organ for diſtributing the nervous power. The PUNCTUM SALIENS, is the heart of the chick; it is ſeen beating while the body of the chick is but a rude, unformed, and gelatinous maſs.

As this ſingular organ exhibits *irritability* the firſt, ſo it never relinquiſhes it till the laſt, and may therefore be conſidered as the PRIMUM MOBILE and ULTIMUM MORIENS of the animal machine.

In animals with cold blood * the *irritability* is very great, and continues a long while. The heart of a *viper* will palpitate when taken from its body twenty-four hours, and that of a *turtle* thirty or longer; and in animals whoſe blood is hot, it moves until the fat is rendered ſtiff by the cold, at which time the motions of the heart and all the other muſcles commonly ceaſe.

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* It is pleaſing, ſays Dr. THORNTON, in his communication to Dr. BEDDOES, to obſerve, that in the animated world, where the *ſtimulus in the blood* is *great*, the IRRITABILITY of the contractile fibre is *leſs*; or in other words, that the IRRITABILITY of the contractile fibre is in exact uniſon with the quantity of *oxygenated blood*. Hence the reaſon of the *long life* of the heart of fiſhes, as it is called, and of all that claſs of animals, whoſe blood is but *little oxygenated* or *cold*, and why theſe ſeem ſo very *tenacious* of life. Vide *the Supplement to Dr.* BEDDOES's *Obſervations on the Nature and Cure of Conſumption, Fever,* &c.

Does not this obſervation confirm the doctrine ſupported in this work, that the IRRITABLE PRINCIPLE is neither OXYGEN nor CALORIC, however it may be increaſed by *theſe principles*? Vide Vol. III. *On Oxygen as the Principle of Irritability*.

The celebrated BOERHAAVE acknowledges an active force in the *heart*, and a latent principle of motion in the pieces of it when cut, but he nevertheleſs attributes this to the *nerves*, though the communication with the brain has been cut off! Dr. WHYTT follows the ſame path, but with this difference of expreſſion, he uſes the term *irritability*, and imputes it to the *ſoul*, which feeling the impreſſion of the *irritation* occaſions the contraction of the fibre, the *ſoul* therefore with him is *deviſible*, and reſides in *every living part* of the body! Accordingly we find alſo, in other books, "All motion is owing to the *ſoul*, which being ſenſible of ſtimuli contracts the fibres which are touched, and pulls them back, to prevent their being injured *."

However ſimple this theory may be; and like the doctrine of *Phlogiſton* among the chemiſts, however

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* This is the *Vis Medicatrix* of CULLEN and the old Phyſicians.

commodious for diſembarraſſing us from ſeveral difficulties, yet as it is not in uniſon with the phænomena, that are obſerved, it muſt be rejected.

1. For, in the FIRST PLACE, the moſt *irritable parts* are thoſe that are *leaſt ſenſible*, and therefore not ſubject to the command of the ſoul, which ought to be quite the reverſe, if the *ſoul* was the principle of *irritability*.

2. In the SECOND PLACE, *irritability* continues *after death*, and in parts quite *ſeparated* from the body, and *deprived* of its *communication with the brain* *, for there is nothing more common than to ſee the heart of a frog beat, and the muſcles remain irritable, after the head has been taken off, and the ſpinal marrow removed.

3. And THIRDLY, it is generally allowed, that the *nerves* are the organs and the *brain* the receptacle of all our ſenſations, the ſources of all our ideas; but the *nerves* and the *brain*, as will be preſently ſhewn,

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* The heart is obſerved before the brain in the embrio chick, and is ſuppoſed therefore to act independent of brain. Some children have grown their full period in the womb, where there has been found after birth *no brain*. Might not IRRITABILITY during the fœtal period ſerve all the purpoſes of *this vegetative life?* but as ſoon as the infant is brought into the world, where voluntary motion and ſenſation is required, a ſtate *advanced above the vegetable*, the babe *without a brain* inſtantly periſhes.

are not irritable, therefore IRRITABILITY HAS NOTHING IN COMMON WITH SENSATION [*].

The Muſcles.

MUSCLES are compoſed of longitudinal fibres which ſhorten themſelves, and are ſo diſpoſed that this contraction always ſerves ſome wiſe purpoſe. They elegantly terminate in tendons, which are braced by ſheathes, and though ſo numerous, each occupies its proper place and juſt direction.

Colour was believed to be eſſential to the conſtitution of a MUSCLE. But in fowls, in amphibious animals, in fiſhes, in worms and inſects, through all the gradations of animals, of different ſpecies or different ſizes, the colours of the muſcular fibre change. In fiſhes, and in inſects, it is generally white; even in the human body, it is not eſſentially red; the fibres of the iris, and the muſcular coats of the arteries, the muſcles of the ſtomach, of the inteſtines, and of the urinary bladder, are colourleſs. We cannot therefore de-fine a muſcle by that property which it often wants; but we may, with the utmoſt propriety characterize it by its CONTRACTILE POWER, the only true evidence of its nature; for the contraction of the iris proves it to be a muſcle by truer marks than its colour; and by the ſame rule the muſcles of a fiſh, or of the meaneſt inſect, are as perfect as thoſe of man.

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[*] The heart is divided into two AURICLES and two VENTRICLES. The AURICLES communicate with their correſponding VENTRICLES, and have VALVES to guard this paſſage. The VALVES on the right ſide are called *tricuſpides*, on the left *mitrales*. THESE prevent the recurrence of the blood into the AURICLES. The AURICLES and VENTRICLES may be ſaid to be hollow muſcles, or rather may be compared to two hollow cavities on each ſide formed of one muſcle, and the left cavities or muſcle are more abundantly furniſhed with fibres, becauſe a greater force is required to propel the blood through the body than the lungs.

Such is the connection betwixt muſcles and their *contractile force*, or PRINCIPLE of IRRITABILITY, that the moment it dies, all its aſtoniſhing power is gone: and the muſcle which could lift a hundred pounds while *alive*, can bear the weight but of a few pounds when *dead*. Whereas, on the contrary, all thoſe parts that are not IRRITABLE, as the ligaments, tendons, &c. are capable of bearing the ſame weight when *dead* as when *alive*.

This IRRITABLE, or CONTRACTILE POWER, in muſcles, is that property by which muſcles recede from certain ſtimuli, without any feeling, without creating any conſciouſneſs of action, and ſo little dependant is it upon nerves, that it is found equally perfect in *animals* * and *plants* which have no nerves, and remains in parts ſevered from the body to which they belong. This IRRITABILITY is ſo far independent of nerves, and ſo little connected with feeling, which is the province of the nerves, that upon ſtimulating any muſcle by touching it with a cauſtic, or irritating it with a ſharp point, or driving the electric ſpark thróugh it, the muſcle inſtantly contracts: although the nerve of that muſcle be tied; although the nerve be cut ſo as to ſeparate the muſcle entirely from all connection with the ſyſtem; although the muſcle itſelf be ſeparated from the body; although the creature upon which it be performed, may have loſt all ſenſe of feeling, and have been long to all appearance dead. Thus a MUSCLE cut from the limb, trembles and palpitates long after; the HEART, ſeparated from the body, contracts when irritated; the BOWELS, when torn from the body, continue their periſtaltic motion, ſo as to roll upon the table, ceaſing to anſwer to ſtimuli only when they themſelves become actually dead. Even in *vegetables*, as in the ſenſitive plant, this contractile power lives. It is by this IRRITABLE PRINCIPLE, that a cut MUSCLE contracts and leaves a gap; that a cut ARTERY ſhrinks and retires into the fleſh. Even when the body is dead to all appearance, and the nervous power gone, this contractile power remains; ſo that if a body be placed in certain attitudes, before it be cold, its MUSCLES will contract, and it will be ſtiffened in that poſture till the organization yields, and begins to be diſſolved. Hence comes the diſtinction betwixt the IRRITABILITY of the muſcles and the SENSIBILITY of nerves; for the IRRITABILITY of muſcles ſurvives the animal,—as when it is active after death;—ſurvives the life of the part, or the feeling of the whole ſyſtem, as in palſy, where the vital motions continue entire and perfect;—and where the muſcles, though not obedient to the will, are ſubject to irregular and violent action;—and it ſurvives the connection with the reſt of the ſyſtem, as where animals very tenacious of life are cut into pieces: whereas SENSIBILITY, the property of the nerves, gives the various modifications of ſenſe, as viſion, hearing, and the reſt; gives alſo the general ſenſe of pleaſure or pain; and thus the eye feels, and the ſkin feels; but their appointed ſtimuli produce *no motions* in theſe parts; they are *ſenſible* but not *irritable*. The HEART, the INTESTINES, and all the MUSCLES of voluntary motion, anſwer to ſtimuli with a quick and forcible contraction; and yet they hardly feel the ſtimuli by which theſe contractions are produced, or at leaſt they do not convey that feeling* to the brain. There is no conſciouſneſs of preſent ſtimulus in thoſe parts which are called into action by the impulſe of the nerves, and at the command of the will: ſo that MUSCULAR PARTS have *all the irritability* of the ſyſtem, with but *little feeling*, and that little owing to the nerves which enter their ſubſtance; while NERVES have *all the ſenſibility* of the ſyſtem, but *no motion*.

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* The polypus, according to John HUNTER, is devoid of nerves.

The nervous influence is a mere ſtimulus to the voluntary muſcles, as blood is to the heart and arteries; food to the ſtomach; or bile to the inteſtines. It loſes its influence over the ſyſtem ſooner, than the irritable principle in the fibre fails: for the irritable ſtate of the muſcle continues long after the voluntary motion, or power of excitement from the nerves, is gone: for when we die *ſlowly*, the irritable principle of the muſcles is exhauſted in the ſtruggles of death. If, while in perfect health, we are killed by a *ſudden blow*, the irritable power of the muſcles ſurvives the nervous ſyſtem many hours or days, and the fleſh trembles, and the abſorbents continue to abſorb *; and often, as after ſuffocation, or drowning, we can, by operating upon this poor remains of life, reſtore the circulation, re-animate the nervous ſyſtem, and recover that life, which ſeemed to have entirely left the body †; and thus the nervous influence, which ſeemed to animate the ſyſtem, and to be the prime mover and ſource of life, owes its reſtoration to that, which was conceived to be but a ſecondary power.

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* The cauſe of this curious phænomenon we ſhall particularly explain, when we come to treat of GANGLIONS. Vide Vol. IV. *Introduction.*

The Diaphragm.

There are *ſome muſcles* which have a *ſtronger contracting force* than *others*, and retain it a longer time after the animal is dead. The chief of theſe is the DIAPHRAGM ‡, which I have always obſerved to move

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[*] Vide Vol. I. Sect. XI. p. 109.

[†] Vide Vol. IV. Sect. XLVII. p. 557. *On the Mode of recovering drowned Perſons.*

[‡] The ſtudy of ANATOMY, as it leads to the knowledge of NATURE, needs not, ſays the illuſtrious CHESELDEN, many tedious deſcriptions, nor minute diſſections; what is moſt worth knowing is ſooneſt learned, and leaſt ſubject to difficulties, while dividing and deſcribing the parts, more than the knowledge of their uſes requires, perplexes the learner, and makes the ſcience tedious, dry, and difficult.

Upon this principle all the anatomical deſcriptions interſperſed in this work will be conducted.

The DIAPHRAGM, or midriff, is a large broad muſcle, that divides the *thorax* from the *abdomen*. In its natural ſtate it is *concave* or vaulted above the move a long while after the other, when the animal was dead, or at leaſt, by irritating the *phrenic nerve* which goes to that muſcle, it could be renewed. I have ſeen it, ſays Baron de Haller, irritable and tremble an hour or more after death, when the motion of the inteſtines had entirely ceaſed, and many others have witneſſed the ſame along with me.

The œſophagus, or gullet.

The ŒSOPHAGUS *, when irritated, contracts itſelf

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the *abdominal viſcera*, and *convex* towards the *thoracic*. It is called, by Haller, "*Nobiliſſimus poſt cor muſculus*," and, like it, is in conſtant action. At the ſame time of inſpiration, it is then a *plane*, and its motions are in general one fourth leſs than the heart. Beſides being a muſcle of inſpiration; it aſſiſts in vomiting, and the expulſion of ſordes; and it marks our paſſions by its irregular action, as ſighing, yawning, coughing, laughing. It is affected by ſpaſms, as in hiccup, lock-jaw, &c. It is both a muſcle of voluntary and involuntary action, and the cauſe of its *involuntary action*, and its *general ſympathy* with all the violent motions of the body, deſerves a fuller attention of the philoſophic anatomiſt than has been hitherto beſtowed upon it. Some ſtrong characters of ſpecial contrivance we cannot fail to obſerve here.

1ſt. The diaphragm ſeparates poſteriorly into *two ſlips*, betwixt which the AORTA DESCENDENS paſſes.

2d. A little above this, and to the left ſide, in the moſt fleſhy part of the diaphragm, there is a *direct opening* for the paſſage of the ŒSOPHAGUS, or gullet.

3d. There is alſo on the right ſide of the diaphragm a large triangular hole for the paſſage of the VENA CAVA ASCENDENS.

* The ŒSOPHAGUS, or gullet, is compoſed both of *longitudi-*

itſelf very ſenſibly, and I have plainly ſeen its periſtaltic motion after death, ſo that a morſel thruſt into the œſophagus will be puſhed upwards and downwards by the periſtaltic motion excited by that ſtimulus.

The Stomach. The STOMACH* is conſiderably *irritable*, and when touched with a corroſive, becomes immediately furrowed. If you irritate it with a knife, either at the *pylorus*, or elſewhere, it preſently contracts itſelf; and when wounded the *borders* of the wound *retract*. You may ſee the *motions* of the *ſtomach* through the tendinous part of the DIAPHRAGM after it has been

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nal, and *circular fibres*, but chiefly *circular*, abundantly more ſo than in the inteſtines; becauſe this has no foreign power to aſſiſt it, and becauſe it is neceſſary the food ſhould make a ſhorter ſtay here than there. Hence it is that horſes drink againſt the law of gravity. The inner ſurface is a ſmooth membrane, abundantly ſupplied with *mucilages*, to ſheath this organ, and render the paſſage of the aliment eaſy.

* THE STOMACH is ſituated on the *left ſide* below the ſhort ribs. The right ſide of the ſtomach is covered by the thin edge of the left lobe of the *liver*; the left preſſes on the *ſpleen*. Its figure nearly reſembles the pouch of a bag-pipe, its *upper ſide* being concave, and the *lower* convex, and its *left end* moſt capacious. The entrance into the *œſophagus* on the left ſide is called the CARDIA; on the right, where the chyme paſſes into the *duodenum*, is named PYLORUS, where there is a CIRCULAR VALVE, or *ſphincter muſcle*, which hinders a regurgitation of the aliment. The ſtomach has *circular* and *longitudinal fibres*, and its *inner membrane* is bedewed with a ſtrong and viſcid mucus.

laid bare, as alſo ſhining through the PERITONÆUM while the abdomen is entire. We therefore cannot doubt an inſtant of this organ being *irritable.*

The Inteſtines

The INTESTINES *, both *large* and *ſmall*, are extremely *irritable.* When the inteſtine is only ſlightly itſelf very ſenſibly, and I have plainly ſeen its periſtaltic motion after death, ſo that a morſel thruſt into the œſophagus will be puſhed upwards and downwards by the periſtaltic motion excited by that ſtimulus.

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* The INTESTINAL CANAL is uſually five times the length of the individual. It is curiouſly convoluted in the abdomen. This ſpace anatomiſts have thought fit to divide into 6 *portions.*

1ſt. The DUODENUM, becauſe it is commonly reckoned in adults to be 12 inches long —At a ſmall diſtance from where the ſtomach joins it, the *common gall duct* and the *pancreatic duct* open into it; from the one it receives the *bile*, and from the other the *pancreatic juice.*

2d. The JEJUNUM, from its being in general found *empty*, on account of the fluidity of the chyme, the ſtimulus of this, and the bile, and the prodigious number of lacteals.

3d. The ILEUM, becauſe of its ſituation near the pelvis, where the bones projecting like the wings of a phaeton are called *Ilea.*

4th. The COLON, which takes an arched direction.

5th. The CÆCUM, or *blind gut*, a pouch, as it were, of the colon, about 3 inches long, and called *blind*, from its being out of the direction of the paſſage of the food. Its diameter is twice as large as that of the other inteſtines. It has an *appendix*, called VERMIFORM, whoſe uſe is not well aſcertained, which floats looſe in the abdomen, and in the mackerel there may be ſeen above 150 of them.

6th. The RECTUM, or *ſtraight gut*, is the laſt, and at its termination is ſurrounded by *circular muſcular fibres*, called the SPHINCTER ANI.

The Stomach. The STOMACH* is conſiderably *irritable*, and when touched with a corroſive, becomes immediately furrowed. If you irritate it with a knife, either at the *pylorus*, or elſewhere, it preſently contracts itſelf; and when wounded the *borders* of the wound *retract*. You may ſee the *motions* of the *ſtomach* through the tendinous part of the DIAPHRAGM after it has been laid

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nal, and *circular fibres*, but chiefly *circular*, abundantly more ſo than in the inteſtines; becauſe this has no foreign power to aſſiſt it, and becauſe it is neceſſary the food ſhould make a ſhorter ſtay here than there. Hence it is that horſes drink againſt the law of gravity. The inner ſurface is a ſmooth membrane, abundantly ſupplied with *mucilages*, to ſheath this organ, and render the paſſage of the aliment eaſy.

* THE STOMACH is ſituated on the *left ſide* below the ſhort ribs. The right ſide of the ſtomach is covered by the thin edge of the left lobe of the *liver*; the left preſſes on the *ſpleen*. Its figure nearly reſembles the pouch of a bag-pipe, its *upper ſide* being concave, and the *lower* convex, and its *left end* moſt capacious. The entrance into the *œſophagus* on the left ſide is called the CARDIA; on the right, where the chyme paſſes into the *duodenum*, is named PYLORUS, where there is a CIRCULAR VALVE, or *ſphincter muſcle*, which hinders a regurgitation of the aliment. The ſtomach has *circular* and *longitudinal fibres*, and its *inner membrane* is bedewed with a ſtrong and viſcid mucus.

laid bare, as alſo ſhining through the PERITONÆUM while the abdomen is entire. We therefore cannot doubt an inſtant of this organ being *irritable*.

The INTESTINES *, both *large* and *ſmall*, are extremely *irritable*. When the inteſtine is only ſlightly

The Inteſtines

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2d. The JEJUNUM, from its being in general found *empty*, on account of the fluidity of the chyme, the ſtimulus of this, and the bile, and the prodigious number of lacteals.

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The

ſlightly cut, the wound equally *retracts* its edges; but if cut quite through, theſe *curl* themſelves *back*, ſo as to embrace the parts above, or in other words, they turn inſide out. When a part of the inteſtine only is irritated, it contracts ſo ſtrongly there, that the cavity is quite cloſed, and the contents are puſhed into the neighbouring parts, either upwards or downwards, which dilate, and ſoon afterwards, being irritated by theſe contents, they contract, and puſh

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The *three* firſt are termed the SMALL GUTS, the *three* laſt the GREAT. In the *ſmall guts*, as is obſerved Vol. II. page 216, there are numerous PLAITS to detain the food, and allow a wider ſurface for its abſorption. Theſe are larger, and far more numerous near the ſtomach, where the food is thinner, than they are towards the colon. At the entrance of the *ileum* into the *colon*, there are two *very large* VALVES, which prevent the regreſs of the fæces into the ileum. The *cæcum* and *colon*, beſides having ſtronger muſcular coats than the ſmall inteſtines, are furniſhed with three LIGAMENTOUS BANDS, running lengthwiſe on their outſide, dividing their ſurface into three portions nearly equal. Though theſe appear like ligaments externally, they are made up in their inner ſtructure of true muſcular fibres. The ligament-like bands, which in the cæcum and colon are collected into *three* portions, are ſpread *equally over* the ſurface of the *rectum*; a wiſe precaution of nature, that no part of it may be weaker than another, leſt it ſhould give way in the efforts of egeſtion. The plaits are conſiderably fewer in the great guts. They have *all* an INNER MEMBRANE, ſtudded with an infinite number of arteries, or glands, which pour out a lubricating fluid. They have *muſcular fibres* both *circular* and *longitudinal*.

along whatever is contained. Very often, after the motions of the inteſtines have ceaſed, they are renewed again, and increaſed by little and little, by ſome *obſcure cauſe* which reſtores their IRRITABILITY. After they have been taken out of the body, I have obſerved, continues Baron de HALLER, *this motion* rather to *increaſe*. They may be irritated *externally* either with a knife, a needle, alcohol, or corroſives, but their *internal ſurface* is much more irritable.

The Ductus Communus Coledochus.

The GALL-DUCT *, and the *other excretory ducts*, are *inirritable*; that is, ſtimuli produce no motion in them.

The Arteries.

The ARTERIES have been always ſuppoſed to be *irritable*. This idea is countenanced, FIRST, by ſeeing that the ſilk-worm has no heart, but only a large artery, which performs the office of a heart. SECONDLY, by the blood after death being expelled, whence theſe derive their name †; and LASTLY, by the motion of the fluids continuing, as may be ſeen in a microſcope, even when the heart has been removed. Unleſs this was the caſe, the *pulſe* of the arteries, which reſembles the ſyſtole and diaſtole of the heart, will be very difficult to be accounted for.

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* Or COMMON DUCT of the *liver* and *gall-bladder*, which enters the *duodenum* oppoſite the *pancreatic duct*. Vide note *, page xxi.

† ARTERIES, from αερ, air; and τραω, to draw. Vide Note *, Vol. I. page 109.

The Lacteals The LACTEALS * contract and empty themſelves like the *arteries*, upon being touched with *vitriolic acid*, and there is the *ſame argument* for their being *irritable* as for the *arteries*, viz. though they be ever ſo full of chyle at the time when the animal dies, they empty themſelves, and contract in ſuch a manner, that you cannot diſcover any fluid within them in the *dead* animal.

When making a puncture with a knife, in *The Bladder.* the BLADDER † of a dog juſt dead, it will *contract* itſelf and force out its contents through the opening made in the abdomen.

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* Called ſo from their containing *chyle*, which has the appearance of milk. The LACTEALS are veſſels of abſorption of infinite ſmallneſs, ſituated in the inteſtines. They increaſe in ſize, and terminate in a gland, called, the RECEPTACULUM CHYLI, whence this fluid proceeds along the THORACIC DUCT, which terminates in the left *ſubclavian vein.* The VALVES of the veſſels of abſorption are innumerable.

† For the anatomical deſcription of this organ vide page xxx.

II. OF INIRRITABLE PARTS.

The LUNGS* appear devoid of *irritability*. *The Lungs.*

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* The LUNGS is ſituated on the right and left ſide of the heart. It is divided into two *lobes*, and theſe are ſubdivided into *lobules*, three on the right ſide and two on the left. The TRACHEA, or wind-pipe, deſcends into the lungs, and forms innumerable CELLS, which have a communication with each other, and give to this viſcus a honey-combed appearance. In the membranes of theſe cells are diſtributed the branches of the *two* PULMONARY ARTERIES, and *four* returning veſſels, or PULMONARY VEINS. "Some have thought," ſays the great CHESELDEN, "that "in theſe cells, the AIR enters the blood-veſſels, and mixes with the "blood; but this opinion, however *probable*, wants ſufficient experiments "to prove it; air being found in the blood, as it certainly is, is no proof "of its entering this way, becauſe it may enter with the chyle. I think, "ſays he, the moſt probable argument for the air's entering into the blood "by the lungs, or rather *ſome particular part* of the air, may be fetched "from the known experiment of each man in a diving-bell wanting near "a gallon of freſh air in a minute; for if preſſure only was wanting, they "often deſcend until the preſſure of the air is three or four times what it is "on the ſurface of the earth. Dr. MONRO obſerves, that the water tor-"toiſe has very large lungs, conſiſting of larger veſicles than in land ani-"mals, and conjectures that this probably is the reaſon, why they bear to "be longer without breathing, as they are provided with a larger quan-"tity of that JE NE SCAI QUOI from the air, which is ſo neceſſary "to life." We ſhall throughout this work trace, as far as poſſible, the true relation we ſtand in with reſpect to the external air, as upon the diſcovery of the true nature of the air, the great myſtery of the office of the lungs and chylification is unfolded, and other matters of the utmoſt importance in the practice of phyſic.

Liver, Kidney, and Spleen.

The LIVER*, KIDNIES†, and SPLEEN‡, have alſo *no irritability*; that is, they do not retract the edges of a wound made in them as do the muſcles, or when irritated ſhew the leaſt motion.

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* The LIVER is the largeſt gland in the body, of a duſky red colour, immediately ſituated under the vaulted cavity of the *diaphragm*, or midriff, chiefly on the *right ſide*, and ſomewhat on the *left* above the *ſtomach*. Exteriorly, or anteriorly, it is convex, inwardly it is concave; very thick in its ſuperior part, and thin in its inferior. The upper ſide adheres to the diaphragm, and it is fixed to this, and the ſternum, or breaſt bone, by a broad ligament, called SUSPENSORIUM. It is alſo tied to the navel by a ligamentous band, called TERES, which is the umbilical vein of the fœtal ſtate degenerated into a ligament. Both theſe bands ſerve to ſuſpend it, while lying on the back, from bearing too much on the ſubjacent *cava*, or otherwiſe it might preſs on this important returning veſſel, ſtop the circulation, and put a period to life. Dogs and cats, and other animals, who are deſigned for leaping, have their liver divided into many diſtinct lobules; which prevent a too great concuſſion of this viſcus. Ours is divided into *two* LOBES, of which the right is conſiderably the largeſt.

† The KIDNIES are two oval bodies, ſituated in the loins, contiguous to the two laſt ſhort ribs; the *right* under the *liver*, and the *left* under the *ſpleen*.

‡ The SPLEEN is ſituated immediately under the *diaphragm*, above the left *kidney*, and between the *ſtomach* and *ribs*. In figure it reſembles a depreſſed oval, near twice as long as broad, and almoſt twice as broad as thick. It has been taken from dogs, ſays CHESELDEN, without any marked inconvenience to them. Its office is the late diſcovery of the celebrated lecturer on phyſiology, Dr. HAIGHTON, a ſhort account of which is given in Vol. II. page 213.

If

The Nerves.

If you irritate a NERVE *, the muſcle to which it is diſtributed is immediately *convulſed*; that is, it contracts its fibres, but in this experiment there will not be found the *ſmalleſt contraction* of the NERVE.

I applied a mathematical inſtrument, ſays Baron de HALLER, marked with very ſmall diviſions, lengthways, to a *long nerve* of a living dog, in ſuch a manner as I was certain to perceive the *ſlighteſt contraction*, but upon irritating the nerve *no contraction* whatever could be perceived.

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* NERVES are white, firm, ſolid cords, which ariſe from the *cerebrum*, *cerebellum*, and *ſpinal marrow*, and are ſpread over every ſentient portion of the body by innumerable filaments. *Ten* pair of nerves iſſue from the brain itſelf, and *thirty* from the ſpinal marrow. Thoſe that go to the organs of ſenſe are conſiderably larger than the reſt, and are in part diveſted of their outer covering or external tunic.

II. OF

III. OF SENSIBLE PARTS.

To point out what parts were *ſenſible*, we have the following experiments.

The Cerebrum, Cerebellum, and Medulla Oblongata.

Upon touching the BRAIN * with a knife, or in whatever way Baron de HALLER did it, or upon applying any cauſtic body, the animal was ſeized with violent convulſions, and contorted his body on the one ſide or the other in the form of a bow, expreſſing by its ſcreams violent anguiſh.

The Spinal Marrow.

Having thruſt a probe, ſays Dr. J. JOHNSON, into the SPINAL MARROW †, all the muſcles of the limbs were violently convulſed.—The muſcles of the back were ſo convulſed, that the animal was bent backwards as in opiſthotonos of the lock-jaw. The intercoſtal muſcles were all contracted, and their natural action, that of drawing all the ribs nearer each other and upwards, was rendered a matter of ocular demonſtration. The diaphragm was alſo ſtrongly contracted.

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* The BRAIN is divided into two portions; that ſituated in the upper part of the ſkull, is called CEREBRUM, and that in the hind part, under the former, CEREBELLUM. On the external ſurface of the brain we ſee ſeveral inequalities, or *windings*, like the circumvolutions of the inteſtines, and the CEREBRUM divides into *two hemiſpheres* while the CEREBELLUM ſends out an *oblong projection*, which paſſes through the large hole of the occiput, called MEDULLA OBLONGATA.

† The MEDULLA SPINALIS, or ſpinal marrow, is a continuation of the *medulla oblongata*.

The Nerves.

The NERVES *, which derive their ſource from the brain, are themſelves extremely ſenſible. It is impoſſible to repreſent to one's ſelf, without having ſeen it, the vaſt pain and diſquietude which an animal is thrown into upon touching, irritating, or even tying a nerve.

The Skin.

The SKIN †, as being abundantly ſupplied with nerves, is found to be extremely ſenſible, for in whatever manner you irritate it, the animal makes a noiſe, ſtruggles, and gives all the indications of pain that it is capable of.

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* The nerves have been before deſcribed page xxvii.

† The SKIN is divided by anatomiſts into two diſtinct coverings. The outer is called CUTICULA, or *ſcarf-ſkin*; the inner CUTIS VERA, or *true ſkin*. Between theſe is interpoſed a ſlimy *mucus*, called RETE MUCORUM;

The Membranes of the Stomach, Inteſtines, Bladder, and Ureters.

The INTERNAL MEMBRANES of the STOMACH *, INTESTINES †, BLADDER‡, and URETERS ||, being of nearly the ſame nature with the ſkin §, does in conſequence enjoy the ſame ſenſibility.

MUCORUM; which is yellowiſh, brown, or black, as is the complexion. "The colour of *this mucus* being the only difference between Europeans, "Indians, and Africans, for the fibres of the true ſkin are white," ſays CHESELDEN, "in all men."

* This part has been deſcribed page xx.

† Vide page xxi.

‡ The BLADDER is ſituated in the lower part of the belly, immediately behind the union of the pudendal bones, and above the rectum, or ſtraight gut. It is the reſervoir of the urine or aqueous part of the blood (a more particular account of the urine will be given when we come to Diabetes) ſecreted by the kidneys and ſent from thence by its ducts, or URETERS; its external paſſage is called URETHRA, the neck of which, or more properly ſpeaking the bladder, is ſecured by a *circular muſcle* called SPINCTER URINÆ, the fibres of which cloſe this opening, except under the great irritationo f diſtention, or from the commands of the will. The coats, or tunics, of the bladder are the ſame as thoſe of the inteſtines, ſtomach, and œſophagus, viz. an *internal* membranous, ſenſible, and ſecreting mucus, a *middle* muſculor, and an *external* alſo membranous, but inſenſible.

|| The URETERS are tubes, about the ſize of gooſe-quills, and about a foot long; they ariſe from the kidnies, and enter the bladder near its neck, running for the ſpace of an inch *obliquely* between its coats, they form to themſelves as it were valves, ſo that upon the contraction of the bladder, the urine is darted along the URETHRA, which is its proper paſſage.

§ Theſe ſeveral parts *differ* anatomically from the ſkin in this. They have no *cuticle*, nor *rete mucoſum*, though they ſecrete a fluid analogous to this. They *differ* from the ſkin alſo in having *muſcular fibres* immediately under them.

The MUSCULAR FLESH is ſenſible of pain, which is dependant entirely on the nerves. For if you tie the nerve going to any part, that part becomes immediately *paralytic* below the ligature and *inſenſible.* Its vital functions however remain. A bliſter applied to the part below the inciſed nerve inflames and draws up the outer ſkin, though it does not create pain; ulcers are healed, and ſuppurate, and the limb ſeems to have loſt nothing but the power of motion.

The Muſcles.

The Mammæ, or BREASTS[*], as being covered with a good deal of ſkin, and furniſhed with many nerves, has alſo a proportionable degree of ſenſibility.

The Breaſt.

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[*] Each BREAST is a CONGLOMERATE GLAND, or an aſſemblage of glands to ſeparate milk, with their EXCRETORY DUCTS, which are capable of much diſtention, tending towards the nipple, and as they approach, unite, ſo as to make but a few ducts at their exit.

IV. OF INSENSIBLE PARTS.

In order to diſcover what parts were *inſenſible*, Baron de Haller made the following experiments.

The Dura Mater.

The DURA MATER * is a kind of perioſteum, every where applied to the internal ſurface of the cranium, connected to it by veſſels, and has arteries tranſmitted through it to the ſkull, in the ſame manner as they are tranſmitted through the perioſteum to the other bones of the body. It is compoſed, like all the other membranes of the body, of cellular ſubſtance, and like them is perfectly *inſenſible*, ſo that it may be burnt with vitriol, cut with a knife, or tore with a pair of pincers, without the animal, the object of the experiment, appearing to ſuffer the leaſt pain.

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* The DURA MATER is a very compact ſtrong membrane lining the inſide of the ſkull, firmly adhering at its baſis, and but lightly at the upper part, except at the ſutures. It extends itſelf acroſs the ſkull, ſo as to divide the *cerebrum* into *two hemiſpheres*. This part of the membrane is called the FALX, and prevents in great meaſure the concuſſion of this part. It again projects laterally, and ſuſtains the poſterior part of the *cerebrum*, which hinders it from compreſſing the *cerebellum*.

The brain naturally divides into two parts. The upper portion is called the *cerebrum*, and the ſmaller and lower portion the *cerebellum*. Theſe are ſheathed by a membranous covering called the PIA MATER *. Having removed, ſays Baron de HALLER, a portion of the ſkull, with the *dura mater* contiguous to it, I touched it with butter of antimony, whereupon it was burnt to a ſcar, without the animal complaining in the leaſt, or making any ſort of ſtruggling, or being at all convulſed.

The Pia Mater.

The inſenſibility of the PERIOSTEUM † was long ago obſerved by Mr. CHESELDEN, nor are we at all ſurpriſed at this, ſeeing there are no nerves diſtributed to it. I have torn and burnt the *perioſteum*, without the animal's ſhewing the leaſt ſign of pain; nay young kids have ſucked during the experiment: whereas when pinched they have ſhewn the moſt evident marks of pain.

The Perioſteum.

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[*] This is an exceeding fine MEMBRANE, which inveſts the brain even between its folds, hemiſpheres, &c.

[†] A ſmooth MEMBRANE covering the bones.

That

The Peri-tonæum. That the PERITONÆUM* is *inſenſible* I proved by repeated experiments, which I carefully made after I had diſſected away the *recti muſcles*, which cover this membrane.

The Pleura. I next made my experiment on the PLEURA †, having freed it from the *intercoſtal muſcles*, which we know are well ſupplied with *nerves* (the experiment was difficult, but I have frequently done it, and moſt ſucceſsfully on a kid, it being a very quiet animal), and even upon the PERICARDIUM *, in all which caſes the membranes being cut or irritated, occaſioned no ſenſe of pain, nor the leaſt change in the animal.

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* Below the diaphragm, or midriff, under the muſcles of the belly, lies that membranous expanſion called the PERITONÆUM, which is a much ſtronger covering than the pleura, and confines the inteſtines and contents of the abdomen.

† Every diſtinct part of the body is covered, and every cavity is lined with a ſingle MEMBRANE, whoſe thickneſs and ſtrength is as the bulk of the part it belongs to, and as the friction to which it is naturally expoſed. Thoſe membranes, which contain diſtinct parts, keep the parts they contain together, and render their ſurfaces ſmooth, and leſs ſubject to be lacerated by the actions of the body; and thoſe which line cavities, ſerve to render the cavities ſmooth and fit for the parts they contain to move againſt. The membranes of all the cavities that contain ſolid parts, are ſtudded with glands, or are provided with veſſels, which ſeparate a MUCUS to make the parts contained move glibly againſt one another, and not adhere together. The PLEURA lines the whole cavity of the cheſt, where the heart and lungs are placed, and gives it that ſmooth and gloſſy appearance, which when theſe organs are removed we cannot fail to obſerve. It meets as it were on the breaſt-bone on each ſide, and then becoming more compact, ſeparates, and extending ſo as to form an acute triangle, it *divides* the two great lobes of the lungs, and is here called MEDIASTINUM. It then paſſes towards the vertebræ of the back, where it aſſumes again the name of pleura.

The Pericardium.

The celebrated STORCH, as appears by the journal of the diſeaſe of which he died, was not ſenſible of any pain, while in performing the paracenteſis, the trocar pierced the PERITONÆUM. Upon this occaſion I foreſee that many eminent phyſicians, who place the ſeat of head ach and phrenites in the MEMBRANES of the brain, and the violent pain of the pleuriſy in the membrane of the PLEURA, will differ from me in opinion. But I only relate facts, and as a ſearcher after truth, it is immaterial to me on which ſide nature decides the queſtion. Neither are theſe truths altogether repugnant to pathology. BOERHAAVE affirmed long ago, that in inſpiration, the PLEURA of the ribs was leſs upon the ſtretch, becauſe the ribs by means of the intercoſtal muſcles approached

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* The PERICARDIUM, or heart-purſe, is an exceeding ſtrong membrane, which covers the heart, even to its baſis. Its uſes are to keep the heart from having any friction with the lungs; and to contain a fluid to lubricate its ſurface. It is firmly faſtened to the great veſſels that enter into, and iſſue from, the heart; as alſo to the diaphragm.

The Peritonæum.

That the PERITONÆUM[*] is *inſenſible* I proved by repeated experiments, which I carefully made after I had diſſected away the *recti muſcles*, which cover this membrane.

The Pleura.

I next made my experiment on the PLEURA[†], having freed it from the *intercoſtal muſcles*, which we know are well ſupplied with *nerves* (the experiment was difficult, but I have frequently done it, and moſt ſucceſsfully on a kid, it being a very quiet animal), and even upon the PERICARDIUM *, in all which caſes the membranes being cut or irritated, occaſioned no ſenſe of pain, nor the leaſt change in the animal.

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[*] Below the diaphragm, or midriff, under the muſcles of the belly, lies that membranous expanſion called the PERITONÆUM, which is a much ſtronger covering than the pleura, and confines the inteſtines and contents of the abdomen.

[†] Every diſtinct part of the body is covered, and every cavity is lined with a ſingle MEMBRANE, whoſe thickneſs and ſtrength is as the bulk of the part it belongs to, and as the friction to which it is naturally expoſed. Thoſe membranes, which contain diſtinct parts, keep the parts they contain together, and render their ſurfaces ſmooth, and leſs ſubject to be lacerated by the actions of the body; and thoſe which line cavities, ſerve to render the cavities ſmooth and fit for the parts they contain to move againſt. The membranes of all the cavities that contain ſolid parts, are ſtudded with glands, or are provided with veſſels, which ſeparate a MUCUS to make the parts contained move glibly againſt one another, and not adhere together. The PLEURA lines the whole cavity of the cheſt, where the heart and lungs are placed, and gives it that ſmooth and gloſſy appearance, which when theſe organs are removed we cannot fail to obſerve. It meets as it were on the breaſt-bone on each ſide, and then becoming more compact, ſeparates, and extending ſo as to form an acute triangle, it *divides* the two great lobes of the lungs, and is here called MEDIASTINUM. It then paſſes towards the vertebræ of the back, where it aſſumes again the name of pleura.

The Pericardium.

The celebrated STORCH, as appears by the journal of the diſeaſe of which he died, was not ſenſible of any pain, while in performing the paracenteſis, the trocar pierced the PERITONÆUM. Upon this occaſion I foreſee that many eminent phyſicians, who place the ſeat of head ach and phrenites in the MEMBRANES of the brain, and the violent pain of the pleuriſy in the membrane of the PLEURA, will differ from me in opinion. But I only relate facts, and as a ſearcher after truth, it is immaterial to me on which ſide nature decides the queſtion. Neither are theſe truths altogether repugnant to pathology. BOERHAAVE affirmed long ago, that in inſpiration, the PLEURA of the ribs was leſs upon the ſtretch, becauſe the ribs by means of the intercoſtal muſcles approached nearer each other, and on the contrary, in expiration, *this membrane* was more *tenſe* becauſe the ribs receded to a greater diſtance from each other. But in *pleuriſy* the patient ſuffers moſt in *inſpiration*; that is, when the PLEURA is *leaſt diſtended*, and *vice verſa*; wherefore that great man did not place the ſeat of this diſeaſe wholly in the PLEURA, but he joined it with an inflammation of the *intercoſtal muſcles*, which ſerve to bring the ribs nearer together, and which we have before proved to be a ſenſible part.

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* The PERICARDIUM, or heart-purſe, is an exceeding ſtrong membrane, which covers the heart, even to its baſis. Its uſes are to keep the heart from having any friction with the lungs; and to contain a fluid to lubricate its ſurface. It is firmly faſtened to the great veſſels that enter into, and iſſue from, the heart; as alſo to the diaphragm.

I am much diſpoſed, ſays the preſent celebrated profeſſor of phyſic at Edinburgh, Dr. MONRO, to join with thoſe who think that we miſtake the true ſeat of the pain in *pleuriſy*. I cauſed, ſays he, the operation for emphyſema to be performed three times, and I was particularly attentive to this queſtion. I ſcratched and tore the PLEURA, yet the patient did not make any remarkable complaint, and I would have concluded ſo, from this plain conſideration, what is the uſe of the pleura? It is a mere ſoft lining to obviate the evil of friction, and I could not imagine that NATURE would have formed this acutely ſenſible. I crooked a probe, and turning the point againſt the

PLEURA, I pricked it rudely, and the patient juſt felt that I was preſſing him, but experienced no pain. In one caſe I cauſed the ſide to be perforated, and introduced a bougie *ten inches*, and turning it round, the patient felt ſomething moving, but no pain. I repeated this ſome days after the operation, when an inflammation was come on, and ſtill with the ſame effect. I have repeated the experiments of HALLER on quadrupeds, cutting away the intercoſtal muſcles, and have torn away the PLEURA without the animal ſeeming to complain

If the dura and pia mater, and likewiſe the perioſteum, and the peritonæum, and pleura, be found void of ſenſation, there is little expectation that other membranes ſhould poſſeſs a different characteriſtic property; and indeed the MEDIASTINUM[*] and OMENTUM[†] are mere reflections of the PLEURA.

The Mediaſtinum and Omentum.

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[*] Vide note †, page xxxiv.

[†] The OMENTUM, or cawl, in Greek επιπλοον, is a broad, thin, and tranſparent membrane, ariſing from the inferior and interior border of the ſtomach, and reaching down as far as the navel; then doubling backwards and upwards, is connected with the colon. Beſides its principle connections with the ſtomach and colon, it is likewiſe attached to the duodenum, to the ſpleen, pancreas, and MESENTERY, which is a membrane faſtened to

The Cellular Membrane.

PLEURA. All theſe membranes being deſtitute of nerves, are of the ſame nature as the CELLULAR MEMBRANE *, and are therefore inſenſible to ſtimuli.

There

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the inteſtines, along which the lacteals run. The omentum lies immediately under the peritonæum. It is every where a double membrane; I ſpeak not of its great fold already mentioned; but every portion of the thin membrane, by itſelf, may be divided into two thinner membranes, which are joined together by cellular texture, in the cells of which the FAT is depoſited. The ſecretion here is performed in the moſt ſimple manner, like ſecretions in plants, there being no glandular apparatus, The fat is diſtributed very unequally in the *omentum*, as you may find it in ſome places very thin and tranſparent, and in other places above an inch thick. The omentum, or cawl, in calves, gives a very beautiful repreſentation of this fact. The *uſes* of the *omentum* are firſt to interpoſe between the peritonæum, the inteſtines, and the ſtomach, to keep all theſe parts moiſt, warm, ſlippery, and to hinder their adheſion; but moſt probably its chief uſe is to furniſh OIL to the liver to be converted into BILE, which is compoſed of *alkali* (azot and hydrogen) and *oil* (hydrogen and oxygen). For the fat, though it is depoſited in the cells of the omentum, yet muſt it have ſome kind of circulation; otherwiſe its ſtore would be continually augmenting beyond meaſure; and as there are here no other excretory ducts but veins, and theſe all terminate in the VENA PORTARUM, which veſſel goes to the liver, carrying to its ſecretory veſſels that fluid, from whence in part BILE is generated; and hence it is a reſervoir for the formation of the bile, as the ſpleen is for the formation of the pancreatic juice.

* The CELLULAR TEXTURE is continued without interruption all over the body, and is inſinuated into every receſs. It is compoſed, not of fibres laid together or interwoven, nor of ſmall tubes, or veſſels, though they run along it, being only adventitious, and no part of its true ſtructure, but of unorganized LAMELLÆ, like fine ſcales. The lamellæ receding from one another, which partly again uniting tranſverſely, forms cells, in

ſuch

The Cuticle.

There is no doubt of the CUTICLE*, or ſcarf-ſkin, being inſenſible, ſeeing you may cut it, as with corns, which is only an increaſed cuticle, or burn it with nitrous acid, until you give it a durable taint, without occaſioning the leaſt pain.

ſuch a manner as to communicate together all over from head to foot. If we conceive a ſpunge, in which every cell opens into all thoſe that are contiguous to it, we ſhall form a juſt idea of the cellular texture. Its CELLS are in ſome places ſmaller, in others larger; it is dilatable by a very ſmall force, where it is not confined by the reſiſtance of neighbouring parts. Where its cells are largeſt, and its texture looſeſt, it contains fat, as immediately under the ſkin, almoſt over all the ſurface of the body, between it and the moſt external muſcles; in the intervals, or interſtices, between one muſcle and another; in the omentum, around the kidneys, &c. This membrane, web, or texture, by laborious diſſection, by blowing air into it, by injections, by maceration, hath been found to follow every viſible bundle of muſcular fibres, every tendon, every veſſel, even every the minuteſt nerve. We ſhall find it conſtituting a great part of the œſophagus, ſtomach, inteſtines, urinary bladder, &c. So that there is no phyſical point in the whole animal fabric, in which there is not a portion of the cellular texture. Its *uſe* and importance in the animal body is very great. It ſerves as a bond of union, by tying and faſtening all the parts together, yet in ſuch a manner, as not to prevent or obſtruct their neceſſary motions: to contain fat, if required; or marrow; or ſerum; or a thin vapour; to render parts ſmooth, and moiſt, and flexible; and to hinder them from growing together. It yields a commodious way or road for veſſels and nerves to glide along. It furniſhes a conſiderable part of the linings of the great cavities of the body, and immediately covers and envelops each particular viſcus of the body; inſomuch that HALLER, who, of all anatomiſts, hath moſt minutely examined, and moſt fully and extenſively conſidered it, declares, "that for certain the far greater part of the animal "body is compoſed of it."

* Vide page xxix

THIS

The Rete Mucoſum. THIS GLUTEN * which divides the cuticle from the cutis vera, or true ſkin, as it cannot eaſily be ſeparated from the cuticle, it becomes impoſſible to try experiments upon it; but one may reaſonably ſuppoſe, like *other fluids*, it has no feeling.

The Fat. The FAT † is a fluid contained within the cellular membrane. That this fluid may be pierced without inflicting pain, may be ſeen by a needle thruſt into the fleſh of a hog, who will ſhew no ſigns of pain, until it has got quite through the fat and reached the fleſh below.

The Tendons. The conſtant event of my experiments was, that the animal whoſe TENDON ‡ was lacerated, burnt, or pricked, remained quiet, without ſhewing any ſigns of pain, and when part of the wounded tendon remained, it would walk without complaining. After I was fully ſatisfied of the event, I had no difficulty in diſcovering the cauſe, there being *no nerves* that I could trace to that part. Seeing therefore in the human body the nerves *only* are capable of ſenſation, it is neither unnatural nor improbable that the tendons being deſtitute of nerves ſhould have no ſenſation. I have oftener than once ſeen the tendons laid bare in men, and, emboldened by the experiments which I have made on brutes, I once laid hold, with a pair of forceps, of the naked tendon of the flexor, that bends the third joint of the fore-finger, without the gentleman being in the leaſt ſenſible of it. I have likewiſe ſeen the ſupinator longus chafed with hot oil of turpentine, in order to ſtop an hæmorrhage ; it occaſioned an acute pain in the ſkin, but the patient felt none in the tendon. Wherefore there is no need of fear from the accident of the ruptured tendon. I have ſeen a new cellular ſubſtance grow in a few days, and unite the TENDO ACHILLIS* that was cut through in a dog. As ſoon as the edges were united, the animal ſuffered no inconvenience, and jumped with the ſame agility upon the chairs as before.

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* Vide page xxix.

† Vide Vol. I. page 27.

‡ TENDONS are not condenſed muſcular fibres, but condenſed cellular membranes attached to muſcular fibres, for the convenience and beauty of this elegant part of our machinery.

When we cut open, ſays BELL of Edinburgh, a faſcia or *tendinous membrane*, there is little pain : when, as in amputation, we cut the tendons even and neat, there is no pain: when we ſnip with our ſciſſars the ragged TENDONS of a bruiſed finger to cut it off, the patient does not feel: and laſtly, when we ſee TENDONS of ſuppurated fingers lying flat in their ſheaths, we draw them out with our forceps, or touch them with probes, without exciting pain. Oil of vitriol has been poured upon each of the parts belonging to a joint, and a piece of cauſtic has been dropped into its cavity, but ſtill no pain enſued; nay, ſome have been ſo bold, may I not ſay ſo vicious, as to repeat theſe experiments upon the human body, pinching, pricking, and burning the TENDONS of the leg, and piercing them with knives, in a poor man, whoſe condition did not exempt him from this hard treatment; who was ignorant of this injuſtice that was done him, while his cure was protracted, and he was made a cruel ſpectacle for a whole city!

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* The tendon of the heel.

In a cat I filled, ſays Baron de HALLER, the articulation of the femur with the pelvis with vitriolic acid, without its ſeeming to feel this violent corroſive. Sometimes inſtead of cauſtics I have tried the knife, and have tranſpierced the CAPSULE of the knee,

The Capſule.

and the LIGAMENTS, and ſcraped the patella, without the animal ſhewing the leaſt ſign of pain. And indeed it is well ordered by nature, that thoſe parts which are expoſed to continued friction ſhould be void of ſenſation *.

The Ligaments.

The inſenſibility of BONES is ſtill diſputed, and indeed I have made no experiments upon this ſubject, for in that cruel torture which is required to lay bare the bones it is nearly impoſſible to diſtinguiſh the two pains. In the large bones I never could find any nerve entering the bone, and I have ſeen the operation of the trepan performed upon ſound perſons who had the free uſe of their ſenſes, without their complaining of any increaſed pain during the perforation of the cranium †.

The Bones.

Several authors have affirmed the MARROW to be extremely ſenſible, but ſeeing no nerves enter the

The Marrow

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* In a ſtate of health theſe parts are certainly *inſenſible*. In the ſtate of diſeaſe is the neighbouring and ſenſient parts *alſo* in a ſtate of diſeaſe, or whence the pain from *white ſwellings*, &c.? This ſubject deſerves the moſt ſerious attention of the philoſophic anatomiſt, and we ſhall again reconſider it when treating on diſeaſes.

† In the caſe of *nodes*, &c. are not the bones ſenſible?

bones, and that it is of the ſame nature as fat, it appears highly improbable.

The Teeth.

The ſenſibility of the TEETH * to heat and cold is wiſely provided, that nothing might paſs into the ſtomach that might irritate ſo important an organ. But otherwiſe they are inſenſible, being often ſcaled and filed without the perſon complaining in the leaſt.

The Gums.

It is wiſely ordained that the GUMS † ſhould be inſenſible. Hence they ſerve, when the teeth are removed, the office of maſtification, and are lanced or cut without the leaſt ſenſation of pain

We have ſeen then there is a difference in the parts of the human body, according to the ſeveral *uſes* for which they are deſigned; ſome are vaſcular and ſoft, others bony and hard; ſome ſenſible, and very prone to inflammation and diſeaſe; others callous and inſenſible, have little action in their natural ſtate, and little proneneſs to diſeaſe.

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* Vide Vol. II. page 240. The TEETH are of three kinds.

1. The *inciſores*, or cutting-teeth, being made of the form of a chiſel.
2. The *canini*, or dog-teeth, being pointed in the form of an awl.
3. The *molares*, or grinders, having a flat and uneven ſurface for grinding, ſhaped like an anvil.

† In the ſtate of *inflammation* they ſeem to have ſome ſenſe of feeling, and excite a dull ſenſation of pain. Vide Vol. VI. *On the Nature of Diſeaſes and their Management.*

The greater part of the body is merely inſenſible and inirritable matter, united into a moving and perfect whole. In ſome places there is ſuch a conflux of nerves, as form the moſt delicate and perfect ſenſe, endowing that part with the fulleſt life; while others are left without nerves, almoſt inanimate and dead, leſt feeling, where it ought not to be, ſhould derange the whole ſyſtem.

The living parts of the ſyſtem are the muſcles and nerves; the *muſcles* to move the body, and perform its offices, each muſcle* anſwering to its particular ſtimuli, and moſt of them obeying the commands of the will; the *nerves* to feel, to ſuffer, and to enjoy, to iſſue the commands of the will, bringing the muſcles into action: but ſtill the muſcles have their own *peculiar life*, or *irritability*, ſuperior to the nerves, and independent of them. It is a power which ſurvives that of the nerves, acting even when ſevered from

* Including the *hollow muſcles*, as the heart, arteries, lymphatics, ſtomach, inteſtines, &c.

the general ſyſtem; and acting often on the living body, without the impulſe of the nerves, and ſometimes in oppoſition to the will.

The inſenſible and inirritable matter of the ſyſtem joins theſe living parts, and performs for them every ſubſervient office,— forms coverings for the brain; —coats for the nerves;—ſheaths for the muſcles;—tendons,—ligaments,—and all the apparatus for the joints;—unites them into one whole by a continued tiſſue of cellular ſubſtance, which has no interruption, and ſuffers no change, but ſtill preſerves its own inſenſible nature, while it joins the ſentient and moving parts to each other. The tendons, ligaments, perioſteum, and capſules of joints, are all compoſed of this cellular ſubſtance, which by its *elaſticity*, binds and connects the parts, and by its dead and inſenſible nature, is leſs expoſed to diſeaſe, and appears therefore to be the fitteſt medium of connection for the *living* ſyſtem.

FIRST,

OF

DIRECT STIMULI.

DEFINITIONS.

STIMULI, are the *exciters* of ACTIONS in animated bodies, and are of *two kinds*.

1. DIRECT, producing TONE, or STRENGTH, in the *fibre*;—and an EXPENDITURE of the *irritable principle*:

2. INDIRECT, producing ATONY, or WEAKNESS, in the *fibre*;—and an INCREASE of the *irritable principle*.

ACTION, or EXCITEMENT, in animated bodies, is the RETROCESSION of the *fibre* upon the application of *ſtimuli*; and is in *proportion*,

1ſt. To the STRENGTH of the *fibre*,

2d. The QUANTITY of *irritable principle*,

And 3d. The DEGREE of *ſtimulus* applied.

THE LAWS OF THE ANIMAL ŒCONOMY, are THE CHANGES that the *fibre* and *irritable principle* undergo, upon the application of *ſtimuli*.

SECT. I.

ON STIMULI.

It has been lately ſhewn, how certain parts of the living body poſſeſs the property of *irritability*, or retroceſſion, upon the application of *certain ſtimuli:* a property which the mimoſa, and other plants, ſeem alſo to partake, and which, being diſtinct from *ſenſibility*, does not depend on the ſame organs. It has been ſhewn alſo how *irritability* reſides excluſively in the *muſcular fibres*, whereas *ſenſibility* was proved to depend on the *nerves*. Thus if a nerve be divided, the *ſenſibility* of the part below the diviſion will be loſt, while its *irritability* ſtill remains. Hence we find thoſe parts which are deſtitute of *nerves* are not *ſenſible*, and thoſe that are deſtitute of *muſcular fibres* are not *irritable*.

When Baron de Haller publiſhed theſe diſcoveries in the year 1747, he formed the æra of a *revolution* in the ſcience of medicine. He ſoon convinced the philoſophic world, that there exiſted in the *living* body a *particular*

particular property, which diſtinguiſhes it from the *dead*, which may be regarded as the principle of all motion, a power diffuſed throughout every organ of the body, and without which, theſe could not perform their ſeveral functions. The diſciples of this great man have therefore the juſteſt reaſon to boaſt, that *phyſiology*, which before had been too long built on metaphyſical and uncertain ideas, might NOW be conſidered as truly ſcientific, being erected on the firm baſis of *actual experiments.*

After *aſtronomy* had ſhewn, that the immenſity of ſpace was filled with innumerable worlds, revolving round innumerable ſuns; thoſe worlds themſelves the centers of others, ſecondary to them, all attracting, all attracted, enlightened, or receiving light, and at diſtances unmeaſureable, did the immortal NEWTON diſcloſe to the aſtoniſhed world THE LAWS WHICH THESE OBEYED.

In like manner, after *anatomy* had demonſtrated a wonderful complicated ſtructure of the human body, the parts ſo delicate, and their relations to, and influence upon, each other ſo immenſe, has another NEWTON, as it were, demonſtrated, that all theſe ſeveral parts OBEY THE SAME GREAT AND FUNDAMENTAL LAWS.

This was the memorable diſcovery of the late Dr. BROWN, a *noted* author and teacher of phyſic, as he is ſtyled by Dr. CULLEN, whom the prejudice of old age, and the pride of celebrity, conſpired from receiving his doctrines, and who would fain perſuade himſelf that the author, whom he *notes*, and againſt whom he proteſts, was really contemptible. For my part, ſays the illuſtrious Dr. BEDDOES, I conſider Dr. BROWN's doctrine of *excitement* as a moſt perfect ſpecimen of extenſive reaſoning, truly calculated to afford the fulleſt ſatisfaction to a juſt thinker. He avoids thoſe unmeaning and vague terms, that had before been ſo much uſed to ſhelter ignorance from their employers and from others; he appeals to the phænomena of the living ſyſtem obvious to the ſenſes; and adopts ſuch principles of reaſoning, that if he has not always diſcovered the truth, he is never forſaken by the ſpirit of a true philoſopher. Dr. DARWIN, who is no leſs eminent as a phyſician than a poet *, entertains ſimilar ſentiments with reſpect to the *Brunonian doctrine*, and allows his work to be, with a few exceptions, a performance of *great genius*. I do not mean here, however, to defend Dr. BROWN's perſonal conduct, which perhaps more than any thing elſe cauſed his doctrines to

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* The celebrated author of *The Botanic Garden*, or *Loves of the Plants*.

be condemned unheard, as if the groſſneſs of a man's manners affected the concluſiveneſs of his arguments. If his imprudence, however, was highly blameable, and his arrogance intolerable, the liberal will allow ſomething to the deep conſciouſneſs of neglected merit, and to the irritating ſenſations attendant upon declining health: and poſterity will perhaps reproach an age, in which a man, poſſeſſed of powers, *ſo ſuperior*, and *ſo nobly exerted*, was brow-beaten, defamed, even driven from his country by ſhameleſs perſecution *, and left to periſh in LONDON in extreme penury. But to return to the main object of this part, *the laws of organic life.*

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* Thank heaven! ſuch *arts* cannot NOW prevail. Knowledge and improvement gain ground every day. Men of ſcience, not bred to the profeſſion, have begun to exerciſe *their own judgment*; and when that comes generally to be the caſe, *true merit* muſt be *encouraged*; many *abſtruſe* doctrines of *old phyſicians* will be exploded; and the tyranny of *empty pomp* and *learned myſtery* in phyſic will be driven out of the land, and forced to ſeek ſhelter among leſs cultivated ſocieties of men. *Philoſophic inſtructions* on the important ſubject of health, delivered in a familiar way, cannot injure in the leaſt *medical men*, who have the high advantage of EXPERIENCE together with EDUCATION; for no ſober man of common ſenſe will truſt the *ſalvation of his ſoul* to a COBLER, nor employ a TAYLOR to defend *his property* in Weſtminſter Hall. I am, therefore, fully perſuaded, ſays Dr. ADAIR, that when the *thinking part* of the nation are taught what has hitherto been called the *myſtery* of the profeſſion, men in general will feel it their duty to ſupport the REGULAR FACULTY, and will be weaned from being *quacked* by MISCREANTS, who are *as little qualified to practiſe phyſic*, as a COBLER is to preach, or a TAYLOR to plead a cauſe, or a MENDER OF KETTLES to repair (an inſtrument *of far leſs complicated ſtructure than the human body)* your watch.

SECT. II.

LAW I.

1. A DUE EXCITEMENT IS NECESSARY FOR THE MAINTAINANCE OF HEALTH AND VIGOUR.

To obtain ſome conception of the grandeur of this ſubject, only imagine to yourſelf, by the ALMIGHTY FIAT, a ſtop put to the *movement* of all things. There would no longer be the ſucceſſion of night and day, the changes of the ſeaſons, the growing of the different productions of the earth, nor wind, nor rain, nor circulation, nor ſecretion, nor life. On the contrary, NATURE is ever performing her eternal rounds, and obedient to the *great command*, we paſs onwards from a ſpeck-like beginning to manhood, and from manhood to old age. While we are thus running our courſe of life, every thing within us is in *a conſtant movement.* If we have exiſted even but a few years, the blood has been circulating from the heart through the lungs, and the body, *countleſs times*; and the ſtomach and inteſtines have been performing *innumerable* wave-like motions.

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* *The laws of organic life*, when fully explained, are ſo obvious to every thinking mind, that it ſeems ſurpriſing they were not earlier elucidated, and brought forward to ſolve a number of difficulties reſpecting diſeaſes, and their proper method of treatment. On account of their great ſimplicity, and their eaſy application in medicine, I durſt not, ſays the learned Dr. BEDDOES, at firſt believe them to be true. They apply equally to the muſcular and ſentient fibres, which therefore throw much additional light and confirmation on each other.

We have before ſhewn * that the *motion* of the heart and arteries, the ſtomach and inteſtines, depended on the *retroceſſion* of *irritable fibres* from *certain ſtimuli*, in the following ſections we ſhall conſider the EFFECTS OF DIFFERENT STIMULI † on the human body.

OF TEMPERAMENT.

EVERY age, every habit, if the excitement by *ſtimuli* be properly directed, has its due degree of vigour ariſing from it. *Childhood*, as poſſeſſing *abundant excitability*, admits of *moderate ſtimuli*; with an under proportion, it becomes *languid*; with exceſs, it ſpeedily feels *oppreſſed*. In *the middle period of life*, where the *excitability* is in

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* Vide Section XI.

† As heat, light, air, food, exerciſe, &c.

due power, a *moderate ſtimulus* is requiſite to ſtir up all the actions of life. *Old age*, on the contrary, owing to a *deficiency* of *excitability*, requires a *great deal* of ſtimulus; it becomes *enfeebled* by too little, and quickly *overſet* by more *.

In one word, EXCITEMENT, the effect of *ſtimulating powers*, when of a *proper degree* and *ſuited to the perſon*, conſtitutes *firm health*; when either *exceſſive* or *deficient*, proves the occaſion of *weakneſs* and *diſeaſe*.

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* This verifies the old adage, " MILK is the food of *infancy*, and WINE of *old age*." What calumnies have not been thrown out againſt JOHN BROWN for this doctrine. If *low living* and *ſtarving* are reprobated for the facts and reaſons that preſently will be aſſigned, why, therefore, ſhould he be called a friend to *intemperance?* On the contrary, he only approves and tries to adjuſt the *proper ſtandard*, condemning all *extremes*, and adviſing the *mean* under which VIRTUE takes her poſt. If he has any ways erred in this *difficult* but *honourable attempt*, as he certainly did not err *wilfully*, I know not why he ſhould be held up as *criminal*, or *cenſured* with *greater aſperity* than the exploded theories of BOERHAAVE or CULLEN. This knowledge will aſſuredly, as Dr. BEDDOES juſtly obſerves, become a part, and the moſt important part, of education. Phyſiological ignorance is the moſt abundant ſource of *our ſufferings*; every perſon *accuſtomed* to the *ſick*, muſt have heard them deplore *their ignorance* of the *neceſſary conſequences* of *thoſe practices*, by which their *health* has been *deſtroyed*; and when men ſhall be deeply convinced, that the *eternal laws of nature* have connected *pain* and *decrepitude* with *one mode of life*, and *health* and *vigour* with *another*, they will avoid the *former*, and adhere to the *latter*. And as actions are oſten named immoral from their effects, ſelf love, or the enjoyment of health, are *ſo far* the ſame. Nor is this ſort of morality likely to terminate in itſelf; but the habit of acting with thought and reſolution, will *extend* from the ſelfiſh to the ſocial actions, and regulate the whole tenour of life.

SECT III.

OF EXTREME HEAT.

HEAT, which is neceſſary, when *moderate*, to the production, growth, and the vigour * of animals and vegetables, may, like *other ſtimuli*, have alſo a *debilitating power*; as muſt be obvious to every one who pays the leaſt attention to the operations in nature. During the *ſcorching heats* of ſummer, eſpecially at mid-day, all nature languiſhes, and her energy is loſt. The plants, exhauſted of their vigour, hang their heads; their foliage droops: and among theſe the MIMOSA *, the DIONÆA MUSCIPULA †, with the HEDYSARUM GYRANS ‡, loſe their ſenſibility and motion; whilſt the various tribes of animals, panting for breath, ſeek ſome cool retreat. Even in our northern latitude this cannot eſcape our notice; but to ſee it in perfection we muſt viſit the more ſultry regions of the ſouth, where the *African*, patient of heat, is obliged to intermit his labour, whilſt the inhabitants of more temperate climates, ſuch as *Italy* and *Spain*, retire into ſome dark receſs and ſleep.

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* Some years ago I cut out, ſays Dr. GARDINOR, the heart and part of the large veſſels of a turtle, with a view to examine the ſtructure of theſe parts, and the circulation of the blood in that animal. Having wiped off the blood and other moiſture, the heart was wrapped up in a handkerchief; but engagements in the way of my profeſſion obliged me to poſtpone my curioſity till about ſix or ſeven hours after it was cut out. When I examined it, there appeared not the *leaſt* ſigns of life. It was much ſhrivelled and dried. But, by putting it into water, nearly *milk warm*, it plumped up, and ſome of its parts acquired a tremulous motion. Laying it on the table, and pricking it with a large needle, it palpitated ſeveral times. The palpitations were renewed, as often as the needle was puſhed into its ſubſtance, until it became *cold*, when it ſeemed to be inſenſible to every ſtimulus. But, after *warming* it again in the water, it recovered its *irritability*, and repeated its palpitations on the application of the needle. Though no movement could be excited in it by any ſtimulus when *cold*, yet it moved ſeveral times after being macerated in *warm water*. *This evidently ſhews the neceſſity of* HEAT *for maintaining the full powers of the contractile living principle.* Vide Sect. IX. Part II.

The learned profeſſor BOERHAAVE gives us ſome experiments, made by the celebrated FAHRENHEIT, with view to diſcover the extent of heat living animals are able to endure.

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* *Senſitive plant.*

† In the DIONÆA MUSCIPULA, or *fly-trap*, there is a moſt wonderful contrivance to prevent the depredations of inſects: the leaves are armed with *long teeth*, and lie ſpread upon the ground around the ſtem. Theſe are ſo *irritable*, that when an inſect creeps upon them, they fold up, and cruſh, or pierce, the poor animal to death.

‡ The leaves of the HEDYSARUM GYRANS, or *whirling honeyſuckle*, are continually in ſpontaneous motion; ſome riſing and others falling; and others whirling circularly, by twiſting their ſtems; this ſpontaneous movement of the leaves goes on when the air is perfectly ſtill. A particular account, with a good print of the HEDYSARUM GYRANS, is given by Monſ. BROUSSONET, in a paper on Vegetable Motions, in the Hiſtoire de l'Academie des Sciences, Ann. 1784, p. 609.

A *ſparrow*, ſubjected to air heated to 146 degrees of *Fahrenheit's* thermometer, after ſome ſtruggles, died in leſs than ſeven *minutes*. A *cat* reſiſted this great heat ſomewhat above a *quarter of an hour*; and a *dog* in about 28 *minutes* died, after diſcharging a conſiderable quantity of a ruddy-coloured foam, which had ſuch offenſive qualities as to throw one of the aſſiſtants into a fainting fit *.

Meſſieurs DU-HAMEL and TILLET, having been ſent into the province of Angoumois, in the years 1760 and 1761, with a view of endeavouring to deſtroy an inſect which conſumed the grain of that province, effected the ſame by expoſing the damaged corn in an oven, where the heat was ſufficient to kill the inſects without injuring the grain. This proceſs was performed at *Rochefoucault*, in a large *public oven*; where, for economical views, their firſt ſtep was to aſſure themſelves of the heat remaining in it on the day after bread had been baked. This they did, by conveying in a thera thermometer on the end of a ſhovel, which, on being withdrawn, indicated a degree of heat conſiderably above that of *boiling water*. But Monſ. TILLET, conceiving that the thermometer had fallen many degrees at the entrance of the oven, and appearing under ſome embarraſſment on that ſcore, a girl, one of the conſtant attendants on the oven, begged that ſhe might enter it, and mark with a pencil the height at which the thermometer ſtood within the oven. The girl ſmiled at M. TILLET's fears, and without heſitation entered the oven, and with a pencil, given her for the purpoſe, marked the thermometer, after ſtaying *two* or *three minutes* at 100 degrees of Reaumur's ſcale, or, to make uſe of a ſcale better known in this country, at near 260 degrees of Fahrenheit's. M. TILLET began to be anxious for this girl, and to entreat her ſpeedy return, but the girl crying out, " She felt no great inconvenience," remained in her preſent ſituation *ten minutes longer*; that is, near about the time when BOERHAAVE's cat parted with her *nine lives* under a much leſs degree of heat. She then came out, her reſpiration quiet, with a hurried pulſe, and a complexion conſiderably heightened.

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* Vide the ſtory of the hole at CALCUTTA, where a *pungent ſteam*, like hartſhorn, is ſaid to have iſſued from thoſe who were at a diſtance from the window.

After M. Tillet's return to *Paris*, theſe experiments were repeated by Monſ. Murantin, at *Rochefoucault*, an intelligent and accurate obſerver, on a ſecond girl belonging to the oven, who remained in it, without much inconvenience, under the ſame degree of heat, as long as the other girl; and afterwards even breathed an air heated to about 325 degrees for the ſpace of *five minutes*.

Theſe experiments ſoon excited other philoſophers to make ſimilar trials, of which, the firſt on record in England, are thoſe of Dr. Dobson, at *Liverpool*, who gives the following account of them in the Philoſophical Tranſactions.

I. TRIAL.

The ſweating-room of our public hoſpital at *Liverpool*, ſays he, which is nearly a cube of nine feet, was heated till the quickſilver ſtood at 202 degrees of Fahrenheit's ſcale. The thermometer was ſuſpended by a ſtring fixed to the wooden frame of the ſky-light, and hung down about the centre of the room. A piece of wax, in this hot ſituation, began to melt in about *ſeven*

ſeven minutes: another piece ſuſpended by a ſtring, and a third piece put into a tin veſſel and ſuſpended, began likewiſe to liquify in about the ſame period of time.

My friend Mr. PARK, an ingenious ſurgeon of this place, went into this ſtove, thus heated, with myſelf. After *ten minutes*, I found his pulſe quickened to 120 pulſations in a minute. To determine the increaſe of the animal heat, another thermometer was handed to him, in which the quickſilver already ſtood at 98 degrees; but it roſe only to 99 degrees and an half, whether the bulb of the thermometer was incloſed in the palms of the hands, or received in the mouth. The natural ſtate of this gentleman's pulſe is about 65.

2. TRIAL.

ONE of the porters to the hoſpital, a healthy young man, and the pulſe 75, was encloſed in the ſtove, when the quickſilver ſtood at 210 degrees, and he remained there, with little inconvenience, for 20 *minutes*. The pulſe now was 164, and the animal heat, determined by another thermometer, as in the former experiment, was 101½.

3. TRIAL.

A young gentleman of a delicate and irritable habit, whoſe natural pulſe is 80, remained in the ſtove ten minutes, when heated to 224 degrees. His pulſe roſe to 145, and the animal heat to 102. This gentleman, who had been frequently in the ſtove during the courſe of the day, found himſelf *feeble*, and diſpoſed to break out in *ſweats* for 24 hours after the experiment.

Even theſe experiments, though more accurate than the former, do not ſhew the *utmoſt degree* of heat which the human body is capable of enduring.

Some other experiments, yet more remarkable, (as in them the body was expoſed to the heat without clothes) are alſo related by Drs. FORDYCE and BLAGDEN, in the Philoſophical Tranſactions. They were made in rooms heated by flues in the floor. There was no chimney in them, nor any vent for the air, excepting through crevices at the door. Of theſe experiments, the two following may be taken as a ſpecimen.

1. TRIAL.

ABOUT three hours after breakfaſt Dr. FORDYCE, having taken off all his clothes except his ſhirt, and being furniſhed with wooden ſhoes tied on with liſt, went into one of the rooms, where he ſtaid *five minutes* in a heat of 90 degrees, and began to *ſweat gently*. He then entered another room, and ſtood in a part of it heated to 110 degrees. In about half a minute *his ſhirt became ſo wet that he was obliged to throw it aſide*, and then *the water poured in ſtreams over his whole body*. Having remained in this heat for *ten minutes*, he removed to a part of the room heated 120 degrees; and after ſtaying there *twenty minutes*, found that the thermometer, placed under his tongue, and held in his hand, ſtood at 100 degrees. His pulſe had gradually riſen to 145 pulſations in a minute. The *external circulation* was evidently increaſed, the veins had become very large, and an *univerſal redneſs* had diffuſed itſelf all over the body, attended with an uncomfortable ſenſe of heat. He concluded this experiment by plunging into water heated to 100 degrees; and after being wiped thoroughly dry, was carried home in a chair; *but the increaſed circulation did not ſubſide for two hours* *.

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* Vide Sect. X. page 103.

2. TRIAL.

Dr. Blagden took off his coat, waiſtcoat, and ſhirt, and went into the room, when ſome water in a metallic veſſel was obſerved to *boil* quickly, and the thermometer indicated a degree of heat above that of boiling water *. The *firſt impreſſion* of this hot air upon the body was exceedingly *diſagreeable*; but in a few minutes all his *uneaſineſs* was removed *by the breaking out of a profuſe ſweat* †. At the end of *twelve minutes* he left the room very much fatigued, his hand ſhook, and he was otherwiſe ſomewhat diſordered. His pulſe beat 136 in a minute, and the thermometer had riſen to 220 degrees.

There ſeems, from theſe experiments, no longer any doubt, but that *heat is debilitating*, and deprives the body of all vigour and ſtrength, and that the *evil effects* of ſuperabundant heat is carried off, in a great meaſure, by *ſenſible perſpiration*. We have, alſo, every reaſon to believe, that the faintneſs of *the body* is communicated alſo to the *mind*. Under ſuch circumſtances, were you to propoſe a bold enterpriſe, you would find, I believe, no daring, no ſpirit. His preſent weakneſs would render him averſe to all exertions of both *body* and *mind*. His only virtue would be paſſive courage, and he would be afraid at that time of every exertion, being in a ſtate of total incapacity.

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* When *cold water* is placed on the fire, it receives freſh acceſſions of heat, until the thermometer riſes to 212 degrees: this is called the BOILING POINT, for the thermometer invariably ſtops at that point, never aſcending the leaſt higher. The *evaporation*, or *ſteam*, that then evidently takes place (which is proportioned to the acceſſion of heat from the fire) ſolves to us the preſent difficulty: for if the ſteam be condenſed, it will be found to give out *that quantity of heat* aſſumed from the fire, which we were juſt now puzzled to account for.

† Vide Sect. X. page 103.

The effects of HEAT, in producing a *noxious quality* in the air, are well known.

In the BRASILS, ſuch are the *putreſcent qualities* of the air, that *white ſugar* will ſometimes be full of maggots.

In *theſe tropical climates* they are obliged to expoſe their *ſweetmeats* by *day* to the ſun, otherwiſe the *night air* would quickly cauſe them to putrefy *. Here life is greatly abridged.

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* On the contrary, in the cold arctic regions, animal ſubſtances, during the winter, are never known to *putrefy*; and meat may be kept for months, without

At SENEGAL, I am told, the natives conſider forty as a *very advanced* time of life, and generally die of *old age* at fifty.

At CARTHAGENA, in America, where the heat of the hotteſt day ever known in Europe is continual,—where, during their *winter ſeaſon*, theſe dreadful heats are united with a continual ſucceſſion of thunder, rain, and tempeſt, ariſing from their intenſeneſs,—the *wan* and *livid complexions* of the inhabitants might make ſtrangers ſuſpect that they were *juſt recovered* from *ſome dreadful diſtemper*:—the *actions* of the natives are conformable to *their colour*; in all their motions there is ſomewhat relaxed and languid;—the heat of the climate even affects their *ſpeech*, which is ſoft and ſlow, and their words are generally broken.

Travellers from EUROPE retain their *ſtrength* and *ruddy colour* in *that climate*, poſſibly for *three* or *four months*;—but *afterwards* ſuffer ſuch decay in *both*, that

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without any ſalt whatſoever. This experiment happily ſucceeded with eight Engliſhmen that were accidentally left upon the inhoſpitable coaſt of *Greenland*, at a place where ſeven Dutchmen had periſhed but a few years before; for killing ſome rein-deer for their ſubſiſtence, and having no ſalt to preſerve the fleſh, to their great ſurpriſe, they ſoon found it did not want any, as it remained ſweet during their eight months continuance upon that ſhore. GOLDSMITH.

they are no longer to be diſtinguiſhed from the inhabitants by their manners or complexion.

Few nations have experienced the mortality of theſe coaſts, ſo much as our own:—in our unſucceſsful attack upon CARTHAGENA, more than *three parts* of our army were *deſtroyed* by the *climate alone*; and *thoſe* that *returned* from that *fatal expedition*, dragged on, ever after, a *languid* and *ſpiritleſs exiſtence.*

In our more fortunate expedition, which gave us the HAVANNAH, we had little reaſon to boaſt our ſucceſs;—inſtead of a *third*, not a *fifth part* of the army were left ſurvivors of their victory, the climate being an enemy that even HEROES cannot conquer *.

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* GOLDSMITH.

SECT. IV.

OF MODERATE HEAT, AND EXTREME COLD.

WHEN the air is of that particular temperature, which is juſt ſufficient for carrying off ſuch a quantity of the heat generated in the body, that the remainder ſhall exactly ſuit the different functions of life, we ſay ſuch an air is *mild*, or it is *temperate*; becauſe we are not ſenſible of any troubleſome degree of *heat* or of *cold*. This preciſe temperature varies in different people, according to the climate, age, and conſtitution, of the individual; but at whatever point of the thermometer this temperature may be, if it falls a few degrees only from that we have been accuſtomed to, we then complain of *cold*, and employ various ways of obviating its diſagreeable effects.

Cold (that is to ſay, the *abſence* of a *certain degree of heat)* ſtrengthens the body, giving vigour to it, and energy to the powers of the mind. Its firſt effect is to abate perſpiration. This is done by conſtricting the capillary veſſels: hence the blood is propelled in an increaſed volume towards the heart. In conſequence of which, the *reaction* of the heart and arteries ſends back the blood with an increaſed velocity and power to the ſurface of the body, ſo as in a healthy ſubject to diffuſe a genial warmth, and create a keen appetite for food, with a ſenſe of lightneſs, alacrity, and ſtrength.

The effects of temperature is, in a moſt ſatisfactory manner, illuſtrated by the learned and ingenious Dr. ROBERTSON, in his Hiſtory of *America*, when taking a view of the effects of climate on the human body, he ſays, "In every part of the earth where man exiſts, "the power of climate operates with *deciſive influence* "upon his condition and character. In thoſe countries "which approach near to the *extremes* of *heat* or *cold*, "this influence is ſo conſpicuous as to ſtrike every eye. "Whether we conſider man merely as an animal, or "as a being endowed with rational powers, which fit "him for activity and ſpeculation, we ſhall find that "he has uniformly attained the greateſt perfection, of "which his nature is capable, in the *temperate regions* of "the globe. There his conſtitution is moſt vigorous, "his organs moſt acute, and his form moſt beautiful. "There, too, he poſſeſſes a ſuperior extent of capa-

" city, greater fertility of imagination, more enter-" priſing courage, and a ſenſibility of heart, which " gives birth to paſſions not only *ardent*, but *perſevering*. " In this favourite ſituation he has diſplayed the utmoſt " effects of his genius, in literature, in policy, in com-" merce, war, and in all the arts which improve and " embelliſh life."

He accordingly divides the natives of AMERICA into *two diſtinct claſſes*; the *one* inhabits the *temperate*, the *other* the *torrid zones*, on both ſide of *the line*. He ſays, " that the human ſpecies in the *former* appears " manifeſtly more perfect: that the natives are more " robuſt, more intelligent, more active, and more " courageous. They poſſeſs, in the moſt eminent de-" gree, that force of mind, and love of independence, " which are regarded as the chief virtues of man in his " ſavage ſtate. Theſe natives accordingly, though ſur-" rounded for ſeveral centuries paſt by poliſhed and " hoſtile nations, have hitherto maintained, in a great " degree, their freedom and independence: but the " *other* claſs, from the debility of their mind and body, " their inactivity, want of active courage, and of that " independence which characteriſes thoſe living in the " more *temperate climates*, have become ſo dependent as "to be nearly in a ſtate of ſlavery to thoſe nations, who, "for the ſake of mines or commerce, have taken poſ- "ſeſſion of their territories."

If we look around the world, we ſhall be able to find not more than *ſix diſtinct varieties* in the human ſpecies, each of which is ſtrongly marked, and ſpeaks the kind ſeldom to have mixed with any other. The race we are at preſent about to conſider are the men found near *the Pole*. Theſe nations being under a rigorous climate, where the productions of nature are but few, and the proviſions coarſe and unwholeſome, their bodies have ſhrunk to the nature of their food. Theſe, therefore, in general, are deſcribed as a race of ſhort ſtature[*], and odd ſhape, with countenances as ſavage as their manners are barbarous. GUSTAVUS ADOLPHUS once attempted to form a regiment of ſuch men, but he found it impoſſible to accompliſh his deſign; for it ſhould ſeem, ſays Dr. GOLDSMITH, as though they were unfitted for any other climate, or mode of life, but their own.

In theſe unhoſpitable regions all is *torpid*. Here you ſee, in the greateſt poſſible perfection, the *ſedative power* of extreme and continued cold. Here no vegetable thrives except the *lichen*; and no animal but the *rein-deer*[*]. Nor is the extremity of *cold* leſs productive of the *tawny* complexion than that of heat. The natives of the *arctic circle* are all *brown*; and thoſe that lie moſt to the north are of a *ſtill darker hue*[†]. In this manner *both extremes* are *unfavourable* to the human form and colour, and nearly the ſame debilitating effects are produced under *Poles* that are obſerved at the *Line*.

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[*] They are uſually about four feet high, and the *talleſt* does not exceed five feet. GOLDSMITH.

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[*] Mr. Townſend.

[†] Cook's Voyage.

SECT. V.

ON LIGHT.

LIGHT, like air and water, is now known to be not a ſimple, but a *compound* body. The all-penetrating genius of Sir ISAAC NEWTON * has demonſtrated, by undeniable experiments, that *a ſingle ray of light*, which former philoſophers imagined ſo infinitely fine, is in reality a collection of *ſeven parts*, which are perfectly diſtinct, and compoſed of as many different colours, and ſubject to different reflections and refractions.

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* It appears to me, ſays Lord *Bolingbroke*, that THE AUTHOR OF NATURE has thought fit to mingle, from time to time, among the ſocieties of men, a few, and but a few of thoſe, on whom he is graciouſly pleaſed to beſtow a larger proportion of *the ethereal ſpirit* than is given in the ordinary courſe of his providence to the ſons of men. Look about you from the palace to the cottage; you will find that the bulk of mankind is made to breathe the air of this atmoſphere, to roam about this globe, and to conſume, like the courtiers of ALCINOUS, the fruits of the earth. *Nos numerus ſumus & fruges conſumere nati.* When they have trod this inſipid round a certain number of years, and begot others to do the ſame after them, they have lived: and if they have performed, in ſome tolerable degree, the ordinary moral duties of life, they have done all they were born to do. Look about you again, nay look, perhaps, into your own breaſt, and you will find that there are *ſuperior ſpirits*, men who ſhew, even from their early youth, though it be not always perceived by

Some modern philoſophers have conſidered *heat* and *light* as one and the ſame ſubſtance. Although, it muſt be confeſſed, they are frequently found exiſting together, yet, on the other hand, muſt it be allowed, that there is often *much dazzling ſplendour* where there is *little* or *no heat*. The Honourable Mr. BOYLE draws a minute compariſon between the light of combuſtible bodies, and that of ſhining wood, &c. Among other things he obſerves, that extreme cold *extinguiſhed* the light of ſhining wood, as appeared when a piece of it was put into a glaſs tube, and held in a freezing mixture. He alſo found that rotten wood did not *waſte* itſelf by ſhining, and upon the application of a thermometer he could not diſcover the ſmalleſt degree of *heat*.

That theſe are diſtinct ſubſtances, may be alſo proved from their diſtinct operations on the *living fibre*.

The muſcular fibres of the retina are excited into inſtantaneous action by the ſmalleſt variation in *light:* but

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by others, perhaps not always felt by themſelves, that they were called into this world for ſomething more and better. Theſe are they, who engroſs almoſt the whole reaſon of the ſpecies, who are born to *inſtruct*, who are deſigned to be the *tutors* and *guardians* of human kind. When they prove ſuch, they exhibit to us examples worthy of the higheſt praiſe, and they deſerve to have their names recorded, inſtead of a crowd of warriors, with whoſe feats the page of hiſtory is crowned and diſgraced.

are inſenſible to the greateſt changes in the circumambient *heat*. Moſt of the diſcous flowers, obedient to the impulſe of *light*, follow the ſun in his courſe. They attend him in his evening retreat, and meet his riſing luſtre in the morning. If a plant be ſhut up in a dark room, and a ſmall hole be made in the ſhutter, through which the *light* may penetrate, you would ſee the different plants confined there, turn towards that hole, and even alter their ſhape to creep through it, ſo that though theſe were *ſtraight* before, they would in a ſhort time become *crooked*, to obtain the full enjoyment of *light*. Thus if a GERANIUM be placed in any window for a certain time, the interior ſurface of every leaf would be turned to meet the *light*; and if you remove it to an oppoſite window, you would ſoon ſee a ſad contortion and confuſion among the leaves, until they had obtained a right poſition with regard to *light*. To prove that it is not *heat*, but *light*, which plants covet, if this GERANIUM be placed near a fire, which gives a ſtronger heat than the ſun, you would ſoon obſerve it turn away its leaves and flowers from the *fire* to the *ſun*.

To illuſtrate this curious circumſtance, Dr. HILL placed a plant of *abrus* in a room, where it had moderate day-light, without the ſun ſhining upon it. The lobes of the leaves were then fallen perpendicularly from the middle rib, and cloſed together by their under ſides. Thus they continued all night. *Half an hour after* day-break, they began to ſeparate, and *a quarter of an hour after* ſun-riſe, were perfectly expanded. *Long before* ſun-ſet they began to droop again, and towards evening were cloſed as at firſt.

Next day the plant was placed where there was *leſs* light. The lobes were raiſed in the morning, but *not ſo much*: and they drooped *earlier* at evening.

The third day it was ſet in a ſouth window, open to the *full ſun.*—*Early* in the morning the leaves had attained their horizontal ſituation: by *nine* o'clock they were raiſed above it, and continued ſo till *late* in the evening; then they fell to the horizontal ſituation, and thence gradually to the uſual ſtate of reſt.

Theſe experiments prove that the whole change is occaſioned by *light* only. To put this beyond diſpute, in the evening of the ſixth day, the plant was ſet in a book-caſe, on which the morning ſun ſhone, the doors ſtanding open. The day was bright. The lobes, which had cloſed in the evening, began to open *early* in the morning, and by *nine* o'clock, they were raiſed in the uſual manner. I then, ſays he, *ſhut* the doors of the book-caſe: on opening them an hour after, *the lobes were all cloſed* as at midnight. On opening the door they expanded again, and in twenty minutes they were fully expanded. This has ſince been many times repeated, and always with the ſame ſucceſs. We can therefore, by admitting or excluding the light, make the plant put on all its changes. Hence we are certain, that what is called *the ſleep of plants*, is cauſed by the abſence of *light* alone, and that their various intermediate ſtates are owing to its different degrees.

Some experiments on plants give us reaſon to believe, that *light* combines with certain parts of vegetables, and that the green of their leaves, and the various colours of their flowers, is chiefly owing to this combination. This much is certain, that plants which grow in darkneſs are perfectly white, languid, and unhealthy, and that to make them recover vigour, and to acquire their natural colour, the direct influence of *light* is abſolutely neceſſary.

It would be difficult, in the preſent ſtate of chemical knowledge, to ſhew the combination of light with *our* bodies. But it cannot but be allowed, that *light* is a ſtimulus, awaking us to muſcular action, and opening an inlet to the ſtimulus of the various paſſions *, and more eſpecially to the powerful influence of ſight. The boy, who was couched for blindneſs by Mr. CHESELDEN, had no great expectation of pleaſure from a *new ſenſe*; he was only excited by the hopes of being able to read and write; he ſaid, for inſtance, that he could have no greater pleaſure in walking in the garden with his ſight, than he had without it, for he walked there at his eaſe, and was acquainted with every turn. He remarked alſo, with great juſtice, that his former blindneſs gave him one advantage over the reſt of mankind, which was that of being able to walk in the night, with confidence and ſecurity. But, when he began to make uſe of this new ſenſe, he ſeemed tranſported beyond meaſure. The brightneſs of the day, the azure vault of heaven, the verdure of the earth, the cryſtal of the waters, all employed him at once, and animated and filled him with inexpreſſible delight. He turned his eyes towards the ſun. Its ſplendour dazzled and overpowered him: he ſhut them once more; and, to his great concern, he ſuppoſed that, during this ſhort interval of *darkneſs*, he was returning to nothing. New ideas now began to ariſe; new paſſions, as yet unperceived, with fears, and pleaſures, all took poſſeſſion of his mind, and prompted his curioſity: love ſerved to complete his happineſs; and every ſenſe was gratified in all its variety.

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* A thick and impenetrable cloud of *darkneſs* on a ſudden enveloped the Grecian army, and *ſuſpended* the battle. AJAX, perplexed what courſe to take, prays thus,

> Accept a warrior's pray'r, eternal Jove ;
> This cloud of darkneſs from the Greeks remove,
> Give us but *light*, and let us ſee our foes,
> We'll bravely fall, tho' *Jove himſelf* oppoſe.

The ſentiments of AJAX are here pathetically expreſſed : it is AJAX himſelf. He begs not for life : a requeſt like that would be beneath a hero. But becauſe in *that darkneſs* he could diſplay his valour in no illuſtrious exploit, and his great heart was unable to brook a ſluggiſh inactivity in the field of action, he only prays for *light*, not doubting to crown his fall with ſome notable performance, though *Jove himſelf* ſhould oppoſe his efforts. LONGINUS.

I had not, perhaps, been thus diffuſe on the article of *light*, unleſs I had obſerved, that all animals, when afflicted with illneſs, fly inſtinctively to ſome *ſilent* and *dark* retreat, where, unaided by art, they quickly recover; and that man, left to the guidance of reaſon only, often falls ſhort in this reſpect of the brute creation, and frequently his powers, already weakened by diſeaſe, get ſtill the more *exhauſted* by an imprudent admiſſion of *company* and *light*.

Every one, who has experienced a nervous fever, ſays the benevolent Mr. TOWNSEND, muſt have felt the diſtreſs that is occaſioned by *theſe ſtimuli* [*].

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[*] Vide *The Guide to Health*, Obſervation the Sixth, on LIGHT.

SECT. VI.

ON AIR.

As this ſubject has been already treated of in Part II. of this work, I ſhall only recapitulate what has been before ſaid, giving, however, *a few additional obſervations* on the *pernicious effects* of BAD AIR.

In PART II. SECT. I. it was ſhewn, "*that air is abſolutely neceſſary for the preſervation of life.*"

In SECT. II. it was ſhewn, *from the deſtruction in the priſon of Calcutta, and the hiſtory of the Lying-in Hoſpital at Dublin, where, in a few years only,* 4000 *children unneceſſarily periſhed,* "*that a due ſupply of air is indiſpenſable.*"

In SECT. III. it was ſaid, "*that atmoſpheric air conſiſted of two parts, of which one is called* VITAL, *becauſe it contributes to life; the other* AZOTIC, *becauſe, being reſpired by animals, it produces in a few minutes death.*" *Thus when theſe two portions are ſeparated, and confined within different jars; a mouſe, or any other animal, will live a conſiderable time in the one, being lively, briſk, and active; whilſt in the other he ſoon languiſhes and dies.*

In SECT. IV. it was ſhewn, "*that the vital, or oxygen, portion of the atmoſphere was by our breathing,*

1ſt, *Converted into* FIXED AIR *(oxygen air* and *charcoal* thrown off from the blood), and

2dly, *It was* ABSORBED *by the venal blood rendering it arterial blood*, and

3dly, *That the oxygen or vital portion of the air being altered or abſorbed, nothing but an atmoſphere of* FIXED *and* AZOTIC AIRS *was left behind, both of which are incapable of ſupporting life.*"

In SECT. V. "*The animal machine was compared to a clock: the wheels whereof may be in ever ſo good order, the mechaniſm complete in every part, and wound up to the full pitch; yet without ſome impulſe to the* PENDULUM, *without the inceſſant ſtimulus of vital or oxygen air in the blood, which alone ſets the* HEART *a going, the whole would remain motionleſs.*"

That *air* is a *ſtimulus* to the heart and arteries in proportion to the OXYGEN AIR it contains (the effects of temperature has been before conſidered), is proved in ſeveral ſections in Part II *. We need therefore only introduce here the language of Dr. THORNTON to Dr. BEDDOES, who ſays, "How great an advantage does the knowledge of the *compoſition* and *effects* of air promiſe to the world, ſince, by means of MODIFIED AIR under the conduct of the *judicious* phyſician, the *actions* the *vital organs* may be *quickened* or *retarded*, and the *ſecretions changed*."

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* See note *, page 110.

Having ſufficiently explained the *ſtimulating effects* of a *pure atmoſphere*, we will now contemplate, for a few minutes, the effects of an *impure* or *noxious air*.

The queſtion whether putrid marſhes are, or are not, unwholeſome, is of conſiderable moment; Dr. PRIESTLEY, therefore, by a clear and concluſive experiment, has proved, that the vapour which ariſes from putrid water is *exceedingly noxious*, and thus guards us againſt the miſchief which might otherwiſe proceed from a careleſs belief of the oppoſite opinion. Happening, ſays Dr. PRIESTLEY, to uſe at *Calne* a much larger trough of water, for the purpoſe of my experiments, than I had done at *Leeds*, and not having freſh water ſo near at hand as I had there, I neglected to change it, till it became offenſive, but by no means to ſuch a degree, as to determine me from not making uſe of it. In this ſtate of the water, I obſerved bubbles of air to riſe from it, and eſpecially in one place, to which ſome ſhelves, that

I had in it, directed them; and having ſet an inverted glaſs veſſel to catch them, in a few days I collected a conſiderable quantity of this air, which iſſued ſpontaneouſly from the putrid water; and putting *nitrous air* * to it, I found that no *change of colour* or *diminution* enſued, ſo that it muſt have been in the higheſt degree *noxious*.

The celebrated Dr. FRANKLIN has likewiſe pointed out the pernicious effects of air from ſtagnant waters. Speaking of the flame which may be lighted up on the ſurface of ſome waters in *America*: I have frequently, ſays this excellent philoſopher, tried the experiment in *England*. One day being employed in ſtirring up the ſtagnant water at the bottom of a deep ditch, I was ſeized ſoon after with an *intermitting fever*, which I can aſcribe to no other cauſe, than to my breathing too much of that *foul air* which I ſtirred up from the bottom, and which I could not avoid while I ſtooped in endeavouring to kindle it.

Contagion is the inſeparable attendant on the PLAGUE, or PUTRID FEVER. The winds may diffuſe *the ſubtle venom*; but, unleſs *the atmoſphere* be previouſly *diſpoſed* for its reception, they would ſoon expire in the cold and temperate climates of the earth.

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* See page 59.

Such was the *univerſal corruption of the air*, that the peſtilence which burſt forth in the fifteenth year of JUSTINIAN was not *checked* or *alleviated* by any *difference of the ſeaſons*. In time its firſt malignity was abated and diſperſed; the diſeaſe alternately languiſhed and revived; but it was not till the end of a calamitous period of *fifty years* that mankind recovered their health, and *the air* reſumed its pure and ſalubrious quality.

No facts have been preſerved to ſuſtain an account, or even a conjecture, of the numbers that periſhed in this *extraordinary mortality*.

I only find, ſays our elegant hiſtorian *, that during three months 5,000, and at length 10,000 perſons died each day at CONSTANTINOPLE,—that many cities of the EAST were left vacant,—and that in ſeveral diſtricts of ITALY the harveſt and the vintage withered on the ground.

In 1720, *the plague* ſwept away from MARSEILLES 50,000 inhabitants, though this city contains at preſent no more than 92,000 ſouls.

In that great *plague* which deſolated the city of LONDON, the conſtitution of the air previous to it was ſingular:—a *hard froſt* during the winter, laſting till near the end of March,—a *ſudden thaw*,—the ground covered with *water* from melted ſnow and ice,—and *great heats* ſucceeding;—men were living, as it were, in a room flooded with *water*, with a *great fire*.

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* GIBBON.

As ſoon as the nature of the diſeaſe was known, 40,000 ſervants were diſmiſſed, and turned into the ſtreets to periſh, for no one would receive them into their houſes; and the villagers near London drove them away with pitch-forks and fire-arms.

Sir JOHN LAWRENCE, "London's generous mayor," ſupported them all, as well as the needy who were ſick, at firſt by expending his own fortune, till ſubſcriptions could be ſolicited and received from all parts of the nation.

HE
"Raiſed the weak head, and ſtayed the parting ſigh,
"Or with new life relumed the ſwimming eye."
Dr. DARWIN.

A pit 40 feet long, 16 feet wide, and about 20 feet deep, was dug in the CHARTER-HOUSE, and in two weeks it received 1,114 bodies.

During this dreadful calamity there were inſtances of mothers carrying their own children to thoſe public graves, and of people delirious, or in deſpair for the loſs of their friends, who *threw themſelves alive* into *theſe pits*.

" One ſmiling boy, her laſt ſweet hope, ſhe warm'd,
" huſh'd on her boſom, circled in her arms,
" Daughter of woe!—ere morn, in vain careſs'd,
" clung the cold babe upon thy milkleſs breaſt,
" with feeble cries thy *laſt ſad aid* required,
" ſtretch'd its ſtiff limbs, and on thy lap expired!"

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" Long with wide eye-lids on her child ſhe gazed,
" and long to heaven their tearleſs orbs ſhe raiſed;
" Then with quick foot and throbbing heart ſhe found
" where CHARTREUSE open'd deep his holy ground;
" Bore her laſt treaſure through the midnight gloom,
" and kneeling dropp'd it in the mighty tomb;
" *I follow next!* the frantic mourner ſaid,
" and living plunged amid the the feſtering dead."

DARWIN.

A pious and learned ſchoolmaſter, who ventured to ſtay in the city, and took upon himſelf the humane office of viſiting the ſick and dying, who had been deſerted by better phyſicians, averred, that being once called to a poor woman, who had buried her children of the plague, he found the room where ſhe lay ſo little that it ſcarce could hold any more than the bed whereon ſhe was ſtretched. However, in this wretched abode, beſide her, in an open coffin, her huſband lay, who had ſome time before died of the ſame diſtemper; and whom ſhe, poor creature, ſoon followed.

What ſhewed the peculiar *malignity* of the air, thus ſuffering from human miaſmita, or effluvia, was, that the contagious *ſteams* had produced SPOTS on the very wall of their wretched apartment: and Mr. BOYLE's own ſtudy, which was contiguous to a peſt-houſe, was alſo ſpotted in the ſame *frightful manner* *.

In the year 1793, the manufactures, trade, and commerce, of PHILADELPHIA, were flouriſhing in the greateſt degree. The number of coaches, chairs, &c. lately ſet up in that city by men in the middle rank of life, is hardly to be believed. And although there had been a very great increaſe of hackney chairs, yet was it next to impoſſible to procure one on a Sunday, unleſs it was engaged two or three days beforehand. Luxury, the uſual, and perhaps inevitable concomitant of proſperity, had eradicated the plain and wholeſome manners of an infant town. Every one looked forward to the full harveſt of proſperity. But how fleeting are all human views! how uncertain all plans founded on earthly appearances! All theſe flattering proſpects, as Mr. CAREY beautifully expreſſes it, vaniſhed like the baſeleſs fabric of a viſion.

In July 1793 arrived the unfortunate fugitives from Cape Francois. And on this occaſion, the liberality of PHILADELPHIA was diſplayed in a moſt reſpectable point of view. Nearly 12,000 dollars were in a few days collected for their relief. Little, alas! did many of the contributors, then in eaſy circumſtances, imagine, that a few weeks would leave their wives and children dependent on public charity, as has ſince unfortunately happened. An awful inſtance of the rapid and warning viciſſitudes of affairs on this tranſitory ſtage.

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* GOLDSMITH.

At this ſeemingly propitious moment, the *deſtroying ſcourge* * crept in among us, and nipped in the bud the faireſt bloſſoms of hope. And, oh! what a dreadful contraſt ſuddenly took place!

Diſmay and affright are viſible in every one's countenance. Moſt people, who can by any means make it convenient, are flying from the city. Of thoſe who remain, many have ſhut themſelves up in their houſes, and are afraid to walk the ſtreets. Thoſe who venture abroad, have handkerchiefs or ſpunges impregnated with vinegar or camphor perpetually at their noſes, or elſe are ſmelling at bottles with the thieves' vinegar. Others carry pieces of tar in their hands or pockets, or camphor bags tied round their necks. Many never walk on the foot path, but go into the middle of the ſtreets to avoid being infected in paſſing houſes wherein people have died. Acquaintances and friends avoid each other in the ſtreets, and only ſignify their regard by a cold nod. Every one appears to ſhift his courſe at the ſight of a hearſe coming towards him. A perſon with a crape, or any appearance of mourning, is ſhunned as a viper. Indeed it is probable LONDON did not exhibit ſtronger marks of terror, than were ſeen in PHILADELPHIA from about the middle of Auguſt till pretty late in September. Many of our firſt commercial houſes are totally diſſolved, by the death or flight of the parties, and their affairs neceſſarily left in ſo deranged a ſtate, that the loſſes, and proteſts of notes, which have enſued, are beyond eſtimation.

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* The privateer SANS CULOTTES MARSEILLOIS, with her prize the FLORA, which arrived the 22d of July, introduced *the contageous fever.* The privateer was in a foul, dirty condition, her hold was ſmall, and perhaps as ill calculated for the accommodation of the *great number of people* that were on board, as any veſſel that ever croſſed the ocean. All her filth was emptied at a wharf between *Arch* and *Race-ſtreet.* A dead body, ſuppoſed to have died of A FEVER, covered with canvaſs, lay on board the FLORA, for ſome time, and was ſeen by Mr. Lemaigne, and other gentlemen. It is certain that the mortality began about that part of Water-ſtreet where the MARY, the FLORA, and the SANS CULOTTES lay. Almoſt every death which at firſt occurred could be without difficulty traced to that ſtreet. Some French lads were alſo among the earlieſt victims.

While affairs were in this deplorable ſtate, and people at the loweſt ebb of deſpair, we cannot be aſtoniſhed at the frightful ſcenes that were acted, which ſeemed to indicate a total diſſolution of the bonds of ſociety in the neareſt and deareſt connexions. Who, without horror, can read of a huſband deſerting his wife, united to him perhaps for twenty years, in the laſt agony;—a wife unfeelingly abandoning her huſband on his death-bed;—parents forſaking their children:—children ungratefully flying from their parents, and reſigning them to chance;—maſters hurrying off their faithful ſervants to the hoſpital, eſtabliſhed out of the town, even on ſuſpicion of the fever, and that at a time when, like Tartarus, it was open to every viſitant, but never returned any;—ſervants abandoning tender and humane maſters, who only wanted a little care to reſtore them to health and uſefulneſs:—who, I ſay, can even now reflect on theſe things without horror? Yet ſuch were the daily ſpectacles exhibited throughout our city. Many men of affluent fortunes, who have given employment and ſuſtenance to multitudes, have been abandoned to the care of a hired negro, after their wives, children, friends, clerks, and ſervants, have fled away, and left them to their fate. With the poor the caſe was, as might be expected, infinitely worſe. Many of theſe have periſhed without a human being to hand them a little water, to adminiſter medicines, or perform any charitable office for them. Various inſtances occur of dead bodies found lying in the ſtreets, of perſons who had no houſe of their own, and looking ill, could procure no ſhelter.

The number of the infected daily increaſing, and every one afflicted with this diſeaſe being refuſed admittance into the alms-houſes, as ſome temporary place was requiſite, three of the guardians of the poor took poſſeſſion of *the Circus*, in which Mr. Ricketts had lately exhibited his equeſtrian feats, being the only place that could be procured for the purpoſe. Thither they ſent ſeven perſons afflicted with the malignant fever, where they lay in the open air for ſome time, without aſſiſtance, for nurſes could not be procured them, though high wages were offered. Of theſe, one crawled out on the common, where he died at a diſtance from any houſe. Two died in the Circus, one of whom was ſeaſonably removed, the other lay in a ſtate of putrefaction for above forty-eight hours, owing to the difficulty of procuring any perſon to remove him.

The inhabitants of the neighbourhood of the Circus took the alarm, and threatened to burn or deſtroy it, unleſs the ſick were removed; and it is believed they would have actually carried their threats into execution, had a compliance been delayed a day longer.

A ſervant girl, belonging to a family in this city, in which the fever had prevailed, was apprehenſive of danger, and reſolved to remove to a relation's in the country. She was, however, taken ſick on the road, and returned to town, where ſhe could find no perſon to receive her. One of the guardians of the poor provided a cart, and took her to the alms-houſe, into which ſhe was refuſed admittance. She was brought back, and the guardians offered five dollars to procure her a ſingle night's lodging, but in vain. And, in fine, after every effort to provide her ſhelter, ſhe abſolutely expired in the cart.

To add to the dreadful affliction of the inhabitants of PHILADELPHIA, the alarm was ſpread throughout the different ſtates of America. The inhabitants of NEW YORK firſt came to a reſolution to ſtop all intercourſe with the infected city; and for this purpoſe guards were ſtationed at the different landings, with orders to ſend back every perſon coming *from* PHILADELPHIA. All perſons taking in lodgers, were called upon to give information of all people of every deſcription, under pain of being proſecuted according to law. All *good* citizens were required to give information to the mayor, of any breach of theſe premiſes.

All theſe ſtrict precautions being eluded by the anxious fugitives from PHILADELPHIA, there was a ſecond meeting held, of the delegates from the ſeveral wards of the city, in order to adopt more effectual methods. At this meeting, it was reſolved to eſtabliſh a night watch of not leſs than ten citizens in each ward, to guard againſt ſuch as might eſcape them by day. Not yet eaſed of their fears, they next day publiſhed an addreſs, in which they mentioned, that notwithſtanding their utmoſt vigilance, many perſons had been *clandeſtinely* landed upon the ſhores of NEW-YORK ISLAND. They therefore again called upon their fellow citizens to be cautious how they received ſtrangers into their houſes; not to fail to report all ſuch to the mayor immediately upon their arrival; to remember *the importance of the occaſion*; and to conſider *what reply they ſhould make to the* JUST *reſentment of their fellow citizens, whoſe lives they might expoſe by a criminal neglect and infidelity.* They likewiſe reſolved, that they would conſider and publiſh to the world, as *enemies to the welfare of the city*, and the lives of its inhabitants, all thoſe who ſhould be ſo ſelfiſh and hardy, as to attempt to introduce any goods, wares, merchandizes, bedding, baggage, &c. imported from, or packed up in, PHILADELPHIA, contrary to the rules preſcribed by that body, who were, they ſaid, deputed to expreſs the will of their fellow citizens.

While our citizens were thus, continues Mr. CAREY, proſcribed in ſeveral cities and towns,—hunted up like felons in ſome,—and debarred admittance and turned back in others, whether ſound or infected,—it is with extreme ſatisfaction I am able to record a few inſtances of a contrary procedure.

A reſpectable number of the inhabitants of *Springfield*, in NEW JERSEY, after a full conſideration of the diſtreſſes of our citizens, paſſed a reſolve, offering their town as an aſylum to the people flying from PHILADELPHIA, and directing their committee to provide a ſuitable place, as an hoſpital, for ſuch of them as might be ſeized with the prevailing *malignant fever*. An aſylum was likewiſe offered to the Philadelphians by ſeveral of the inhabitants of *Elkton*, in MARYLAND; and the offer was couched in terms of the utmoſt ſympathy for the diſtreſſes of the *Philadelphians*.

At this time the diſorder was raging with increaſing vehemence. By order of the mayor the *bells* were ſtopped from tolling. This was a very expedient meaſure; as they had before been kept pretty conſtantly going the whole day, ſo as to terrify thoſe in health, and drive the ſick, as far as the influence of imagination could produce that effect, to their graves. An idea had gone abroad, that the burning of *fires* in the ſtreets would have a tendency to purify the air, and arreſt the progreſs of the diſorder. The people had, therefore, almoſt every night large fires at the corners of each ſtreet. The mayor publiſhed alſo a proclamation forbidding this dangerous practice. As a ſubſtitute, many had recourſe to the firing of *guns*, which was imagined a ſure preventative of the diſorder. This was carried ſo far, and attended with ſo great noiſe, that it was alſo forbidden by an order from the mayor.

The ſituation of the *public hoſpital* was moſt dreadful. A profligate and unfeeling ſet of nurſes (none of good character could be procured at this moment) rioted on the proviſions and comforts prepared for the ſick, who (unleſs at the hours the doctors attended) were left almoſt entirely deſtitute of every aſſiſtance. The dying and dead were indiſcriminately mingled together. The ordure and other evacuations of the ſick were often allowed from inattention to remain. Not the ſmalleſt order or regularity exiſted. It was, in fact, a great *human ſlaughter-houſe*, where numerous victims were immolated at the altar of riot and intemperance. No wonder, then, that a general dread of the place prevailed throughout the city, and that a removal to it was conſidered as the ſeal of death. In conſequence, there were various inſtances of ſick perſons locking their rooms, and reſiſting every attempt to carry them away. At length the poor were ſo much afraid of being ſent to BUSH-HILL, that they would not acknowledge their illneſs, until it was no longer poſſible to conceal it. For it is to be obſerved, that the fear of the contagion was ſo prevalent, that as ſoon as any one was taken ſick, an alarm was ſpread among the neighbours, and every effort was uſed to have the ſick perſon hurried off to BUSH-HILL, to avoid ſpreading the diſorder. The caſes of poor people forced in this way to that hoſpital, though labouring under only common colds, and common fevers of irritation, are numerous and afflicting. There were not wanting inſtances of perſons, only ſlightly ill, being ſent to BUSHHILL, by their panic-ſtruck neighbours, and embracing the firſt opportunity of running back to PHILADELPHIA.

At this time a circumſtance however occurred, which alone would be ſufficient to reſcue the character of man from obliquy and reproach. As a human being, I rejoice, ſays the benevolent Mr. CAREY, that it has fallen to my lot, to be a witneſs and recorder of the fact. STEPHEN GERARD, a *wealthy* merchant, and native of *France*, touched with the wretched ſituation of the ſufferers at BUSHHILL, voluntarily and unexpectedly offered to ſuperintend that hoſpital. The ſurpriſe and ſatisfaction excited by this extraordinary effort of humanity, can be better conceived than expreſſed. PETER HELM, a native of *Penſylvania*, actuated by the like benevolent motives, offered his ſervices alſo in the ſame department.

To form a juſt eſtimate of the value of the offer of theſe good men, it is neceſſary to take into full conſideration the general conſternation, which at that period pervaded every quarter of the city, and which made attendance on the ſick be regarded little leſs than *certain ſacrifice*. Uninfluenced by any reflections of this kind, without any poſſible inducement, but the pureſt motives of humanity, they came forward, and undertook what would by *others* be deemed a forlorn hope. They underwent a laborious round of duty. They inceſſantly encouraged and comforted the ſick, they gave them neceſſaries and medicines, they even performed many diſgusting offices of kindneſs, which nothing could render tolerable, but the exalted motives that impelled them to *this heroic conduct.*

On the contrary, *the jail* of PHILADELPHIA is under ſuch excellent regulations, that the diſorder made its appearance there only in two or three inſtances, although ſuch abodes of miſery are the places where contagious diſorders are moſtly generated. When this putrid fever raged moſt violently in the city, there were in the jail one hundred and ſix French ſoldiers and ſailors, confined by the order of the French conſul, beſides eighty convicts, vagrants, and perſons for trial; all of whom except two or three remained perfectly free from the complaint. Several circumſtances conſpired to produce this ſalutary effect.

The people confined are frequently cleanſed and purified by the uſe of the hot and cold bath;—they are kept conſtantly employed;—vegetables form a conſiderable portion of their diet;—in the yard vegetation flouriſhes;—and many of them being employed in ſtone cutting, the water, conſtantly running, keeps the *atmoſphere* in a *moiſt* and *pure* ſtate. Whereas the inhabitants of dirty and confined ſtreets have ſeverely expiated their

neglect of cleanlineſs and decency, by the number o
them that have fallen ſacrifices. Whole families in ſuch houſes have ſunk into one ſilent and undiſtinguiſhed grave.

As I have been obliged to note a variety of horrid circumſtances, which have a tendency to throw a ſhade over the human character, it is proper to reflect a little light on the ſubject, wherever juſtice and truth will permit it. Here it ought to be recorded, that ſome of the convicts in the jail voluntarily offered themſelves as *nurſes* to attend the ſick at BUSHHILL, and have in that capacity conducted themſelves with ſo much fidelity and tenderneſs, that they have had the repeated thanks of the managers.

In the progreſs of this diſorder, from the numerous deaths of heads of families, a great number of children were left in a moſt abandoned and forlorn ſtate. The bettering houſes, in which ſuch helpleſs ſubjects have been uſually placed, was barred againſt them. Many of theſe little innocents were actually ſuffering for want of even common neceſſaries. The deaths of their parents and protectors, which ſhould have been the ſtrongeſt recommendation to public charity, was the very reaſon of their diſtreſs, and of their being ſhunned as a peſtilence. The children of a family, once in affluent circumſtances, were found, their parents being dead, in a blackſmith's ſhop, ſqualid, dirty, and half ſtarved, having been for a conſiderable time without even a taſte of bread. This early caught the attention of the humane, and 160 children were ſoon reſcued from this forlorn condition, and lodged in a building called the *Loganian Library*.

Rarely has it happened, that ſo large a proportion of the gentlemen of the faculty have ſunk beneath the labours of their very *dangerous profeſſion*, as on this occaſion. In little more than a month, exclusive of medical ſtudents, no leſs than *ten phyſicians* have been ſwept off. Hardly any of the *apothecaries*, who remained in the city, eſcaped from indiſpoſition. The venerable SAMUEL ROBESAN has been, like a good angel, indefatigably performing, in families where there was not one perſon able to help another, even the menial offices of the kitchen, in every part of his neighbourhood. JOHN CONNELLY has ſpent hours beſide the ſick, when their own wives and children had abandoned them. Twice did he catch the diſorder,—twice was he on the brink of the grave, which was yawning to receive him,—

yet, unappalled by the imminent danger he had eſcaped, he again returned to the charge.

To habits *defectively* OXYGENATED, as with tiplers, and drunkards, and men of a corpulent habit, and women with child, this diſorder proved very *fatal.* Of theſe many were ſeized, and the recoveries were very rare *.

If you examine the regiſter of the weather, you will find there was *no rain* from the 25th of Auguſt until the 14th of October, except a few drops, hardly enough to lay the duſt in the ſtreets, which fell on the 9th of September, and the 12th of October. In conſequence of which, the ſprings and wells failed in many parts of the country. The duſt in ſome places extended two feet below the ſurface of the ground. The paſtures were deficient, or burnt up, and there was a ſcarcity of autumnal fruits in the neighbourhood of the city. The regiſter of the weather ſhews alſo *how little* the *air* was *agitated* by *winds* during the above time. In vain were the changes of the moon expected to alter the ſtate of the atmoſphere. The light of the morning, as conſtantly mocked the hopes, which were raiſed by a cloudy ſky in the evening. Hundreds ſickened each day beneath the influence of the ſun; and even when his beams did not excite diſeaſe, they produced a languor in the body, and to uſe the country phraſe, the labourer in the field gave in, and that too when the mercury in the thermometer was under 80 degrees. On the 12th of September a *meteor* affrighted the inhabitants. *Muſchetoes* were uncommonly numerous. Here and there a dead cat added to the impurity of the air of the ſtreets; for many of thoſe animals periſhed with hunger in the city, in conſequence of ſo many houſes being deſerted by the inhabitants who had fled into the country.

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* Vide the Section *on Fevers,* in Part IV. ON THE NATURE OF DISEASES, AND THEIR PROPER TREATMENT.

However inoffenſive uniform heat, when agitated by gentle breezes, may be, there is I believe no record, where a dry and ſtagnating air has exiſted for any length of time without producing diſeaſe. HIPPOCRATES, in deſcribing a peſtilential fever, ſays, the year in which it prevailed was without a breeze of wind. The ſame ſtate of the atmoſphere for ſix weeks, is mentioned in many of the hiſtories of the plague which prevailed in London in 1665. Even the ſea air itſelf becomes unwholeſome by ſtagnating; hence Dr. CLARK informs us, that ſailors become ſickly after long calms in their voyages to the

Eaſt Indies. Sir **John Pringle** delivers the following aphoriſm from a number of ſimilar obſervations upon this ſubject. " *When the heat comes on ſoon, and continues throughout autumn, not moderated by winds, or rains, the ſeaſon proves ſickly, diſtempers appear early, and are dangerous.*"

A TABLE OF DEATHS.

		Died.			*Died.*				*Died.*
August	1	9		5	20			10	93
	2	8		6	24			11	119
	3	9		7	18			12	111
	4	10		8	42			13	104
	5	10		9	32		Rain,	14	81
	6	3		10	29			15	80
	7	12		11	23			16	70
	8	5		12	33			17	80
	9	11		13	37			18	59
	10	6		14	48			19	65
	11	7		15	56			20	55
	12	5		16	67			21	59
	13	11		17	81			22	82
	14	4		18	68			23	54
	15	9		19	61			24	38
	16	7		20	67		Cloudy,	25	35
	17	6		21	57		Cloudy,	26	23
	18	5		22	76		Rain, -	27	13
	19	9		23	68		Rain, -	28	24
	20	7		24	96		Fair, -	29	17
	21	8		25	87		Rain, -	30	16
	22	13		26	52		Rain, -	31	21
	23	10		27	60	Novem.	Rain,	1	13
	24	17		28	51		Fair, -	2	21
	25	12		29	57		Cloudy, -	3	15
	26	17		30	63		Rain, -	4	15
	27	12	October	1	74		Rain, -	5	14
	28	22		2	66		Cloudy, -	6	11
	29	24		3	78		Fair, but cold,	7	15
	30	20		4	58		Fair, -	8	8
	31	17		5	71		Fair, -	9	6
Septem.	1	17		6	76		Fair, -	10	2
	2	18		7	82		Fair, -	11	0
	3	11		8	90				
	4	23		9	102		Total	-	4000

From this table it appears that the principal mortality was in the ſecond week of October. A general expectation had obtained, that *cold weather* was as deſtructive of the contagion of this fever as *heavy rains*. The uſual time for its arrival had come, but the weather was ſtill not only moderate, but warm. In this awful ſituation, the ſtouteſt hearts began to fail. Hope ſickened, and deſpair ſucceeded diſtreſs in almoſt every countenance. On the 14th of *October* it pleaſed God to alter the ſtate of the air. The clouds at laſt dropped health in *ſhowers* of rain, which continued during the whole day, and which were ſucceeded for ſeveral nights afterwards by *cold* and *froſt*. The effects of this change in the weather, appeared firſt in the ſudden diminution of the ſick, for the deaths continued for a week afterwards to be nearly as numerous, but they were of perſons who had been confined before, or on the day in which the change had taken place in the weather.

The appearance of this *rain* was like a dove with an olive branch in its mouth, to the whole city. Public notice was given of its beneficial effects in a letter ſubſcribed by the mayor of Philadelphia, who acted as preſident of the committee, to the mayor of New York.

To Richard Vanche, Esq.

"Sir,

"I am favoured with your letter of the 12th inſtant, which I "have communicated to the Committee.

"The part, Sir, which you perſonally take in our afflictions, and which "you have ſo pathetically expreſſed in your letter, excites in the breaſts of the "Committee the warmeſt ſenſations of affection. The ſubſcription made in "New York is a balm to the ſores of our diſtreſſed city.

"I am overjoyed as I inform you, that the refreſhing *rain* which fell on "the 14th, though light, and the *cool weather* which hath ſucceeded, appear "to have given a check to the prevalence of the fever. Few ſince appear to "have taken the infection; the applications for the hoſpital are few, and the "funerals are decreaſed.

"With ſentiments of the greateſt eſteem and regard, &c."

On the 30th and 31ſt of October there was a conſiderable fall of *rain*. The fever was in conſequence wholly ſubdued. A viſible alteration ſoon took place in the city. Every hour long abſent and welcome faces appear,—and in many inſtances, thoſe of perſons whom public fame has buried for weeks paſt. The ſtores, ſo long cloſed, are opening faſt. Some of the country merchants, bolder than the reſt, are daily venturing into their old place of ſupply. Market-ſtreet is almoſt as full of waggons as uſual. The Cuſtom-houſe, for weeks nearly deſerted by our mercantile people, is thronged by citizens entering their veſſels and goods:—the ſtreets too, long the abode of gloom and deſpair, have aſſumed the buſtle ſuitable to the ſeaſon. The arrival in the city of our beloved Preſident, continues Mr. Carey, gives us a flattering proſpect of the next ſeſſion of congreſs being here. And, in fine, as every thing in the early ſtage of the diſorder, ſeemed calculated to add to the conſternation; ſo now, on the contrary, every circumſtance has a tendency to revive the hopes and happineſs of our afflicted city *.

In the year 1732-3, there happened throughout Europe an *epidemic* of a moſt dreadful nature.

The *previous conſtitution of the air* occaſioned a *great* drought, which may be inferred from the failure of the ſprings, and the abatement of freſh water in all its uſual currents and reſervoirs.

In ENGLAND we had little if any froſt; great *fogs* were much noticed in GERMANY and FRANCE.

In the *latter* kingdom there was, about Chriſtmas, a trifling fall of ſnow. This was ſucceeded with conſtant *ſoutherly winds*, and *offenſive fogs*, during which there was obſerved by ſome ſurgeons a great diſpoſition in wounds to *mortify*.

Both *before* and *during* the continuance of the *epidemic* in ENGLAND the air was *unuſually warm* for the time of the ſeaſon, with *ſtorms* of wind from the ſouth-weſt, *lightnings*, and *thunder*.

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* This fever ſwept off about 4,000 perſons. Vide note *, page 41.

The *time* of *invaſion* was *different* in *different* countries.

An *uniformity* of *ſymptoms*, however, was remarkable every where.

A *ſmall rigour* or *chillineſs*,—ſucceeded by a *fever* of a duration (in ſuch as recovered) ſeldom above three days.

This fever was attended with *headach*,—*pains along the back*,—*ſlight thirſt*,—*ſneezing*,—*a thin defluxion from the noſe and eyes*,—*a cough*, *with expectoration of phlegm*, and when this matter became purulent, the diſeaſe proved fatal.—The *cough* continued with ſome ſix weeks or two months.

This *epidemic* invaded SAXONY, and the neighbouring countries in GERMANY, about the fifteenth of *November*.

It was *earlier* in HOLLAND than in ENGLAND; *earlier* in EDINBURGH than in LONDON.

It was in NEW-ENGLAND before it attacked BRITAIN; in LONDON before it reached ſome other places *weſtward*, as OXFORD, BATH, &c.—and, as far as I can collect from accounts, it invaded the *northerly parts* of EUROPE before the *ſoutherly*.

It laſted in its vigour in LONDON—from about the middle of *January* 1733 for about *three* weeks:—the Bills of MORTALITY, from *Tueſday* the 23d, to *Tueſday* the 30th of January, contained 1,588 perſons, being higher than any time ſince the plague.

There was, during the whole ſeaſon, a great run of hyſterical, hypochondriacal, and nervous diſtempers.

I ſhall only add, that the *horſes* were ſeized with *the catarrh* before men, and that *dogs* were reported to have gone mad long before the autumn.

The epidemic catarrh, whenever it appears, ſpreads, from province to province, till it has extended over Europe, or even croſſed the Atlantic to America. A few years back I had, ſays the Rev. Mr. TOWNSEND, a moſt ſtriking demonſtration of its progreſſive march. I was at *St. Agnes*, in Cornwall, but before it reached u I removed with all my family to *Lanlivery*. There we continued ſafe, whilſt the diſeaſe was ſpreading in the pariſh of *St. Agnes*; and on our return we found that few perſons had eſcaped, but that it had quitted them, and was extending weſtward to the extremity of Cornwall.

Dr. CULLEN has collected a regiſter of epidemical catarrhs to the amount of twenty-five, between the years

1323 and 1767: but other practitioners have greatly increaſed this liſt.

Lime-kilns throw off large quantities of *fixed air*; and thoſe who incautiouſly lay themſelves down either on the walls of the kiln, or ſo near as to be expoſed to the vapour which riſes from the burning lime-ſtone, often experience its pernicious effects. Some years ago, I remember a poor family, ſays Dr. FALCONER of Bath, who lodged in a room adjoining to a lime-kiln; during the night, the vapour of the burning lime made its way into the room, and the four perſons of which the family conſiſted were all killed. In the morning they were found lying as in a compoſed ſleep, without any appearance of having gone through either pain or ſtruggle.

In the ſpring of the year 1778, two diſorderly young women, after rambling about the town for a conſiderable part of the night, crept early in the morning into a little hovel which was contiguous to a *lime-kiln*. The kiln was charged and burning, and the vapour of the lime was forced through ſome crevices into the hovel. After ſome hours, the man who had the care of the kiln came to look after his work, and finding theſe women as he ſuppoſed aſleep, went away without diſturbing them. Some time after he returned, and ſeeing them ſtill in the ſame place, endeavoured to awaken them, but in vain; they were cold and motionleſs. In one there did not appear to be the leaſt remains of life; and in the other there was only a ſlight and indiſtinct movement about the heart. This patient was ſoon conveyed to the hoſpital. By proper means ſhe was recovered, and ran away from the hoſpital, without expreſſing the leaſt ſenſe of gratitude for the care and humanity which had been exerciſed towards her. The other was not conveyed to the hoſpital ſo early, and the ſame means were uſed, but without ſucceſs.

The moſt neat and delicate perſon, after having paſſed the night in his bed-chamber, does not, when he awakes, diſcover any faint ſmell in his room: but if he quits it only for a few minutes, and returns to it, after having been in the open air, and before freſh air has been admitted, he will quickly diſcern an eſſential difference.

If theſe evils ariſe from animal effluvia, in apartments frequented by the opulent, nice, and elegant, who have the means and diſpoſition to promote neatneſs and cleanlineſs; how much more injurious muſt *ſtagnant air* be in the hovels of the indigent, who are deſtitute of all the conveniences, and many of the neceſſaries, of life.

In order to be ſatisfied of the truth of this obſervation, we need only look into the great manufacturing towns, where we ſhall find a *puny degenerate* race of people, *weak* and *ſickly* all their lives, ſeldom exceeding the middle period of life; or if they do, being unfit for buſineſs, they become a burthen to ſociety. Thus arts and manufactures, though they may increaſe the *riches* of a country, are by no means favourable to the *health* of its inhabitants.

UNWHOLESOME AIR, ſays Dr. BUCHAN, author of the Domeſtic Medicine (a work ſhewing accurate obſervation, and great experience, but *incapable of forming the practitioner* *), is a very common cauſe of diſeaſe. Few, ſays he, are aware of the danger ariſing from *bad air*. People generally pay ſome ſmall attention to what they eat and drink; but ſeldom regard what goes *into the lungs*, though the latter proves often more ſuddenly fatal than the former.

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* This work always puts me in mind of the *Edinburgh Pharmacopœia Pauperum*, and the *Hereditary Shop* I found in *Ireland* where each drawer containing medicines was carefully labelled. "For FEVERS, FITS, SORE EYES, &c.!" When Dr. ———, who gave his advice for one ſhilling, died at Marlborough, his STABLE-BOY married his widow, and continued in his houſe, and therefore naturally ſucceeded to his buſineſs. Unfortunately the preſcription-book of the deceaſed was not *titled*, and a patient would therefore frequently come for a cure of the *gripes*, and he was given JALAP; for *vomiting*, and he had ANTIMONIAL WINE; for *pain in the ſtomach*, whether ariſing from *wind* or *inflammation*, and he had PEPPERMINT WATER; and the doſes were *the ſame*, however the conſtitutions might *differ*. The late cele- Dr. HUGH SMITH uſed to *robe* a man of an *impoſing countenance*, who, when he was abſent at a fox-chaſe, heard his *home patients* with ſignificant attention, and

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and would take out the Doctor's preſcription, which was previouſly written, and *receive the fee*. When *a ſtranger* came on ſuch days he was deſired to go to the PLACEBO drawer in the next room. Seeing, at laſt, HOW EASY IT WAS TO BE A DOCTOR, *this man* tranſcribed *theſe formula*, and ſet up for himſelf. But being afterwards taken very bad, he did not hazard *on himſelf* one of the *ſtolen formula*, and fortunately for ſociety he was taken off by this diſeaſe, but not *before* he had ſet up *his chariot*. Smith's Formula are now publiſhed, and was bought lately at an auction, lotted with Killing no Murder, for *two ſhillings*.

The province of every teacher of phyſic is to diſcover and explain the *cauſes* of diſeaſe, as well as *the remedies*. Thus JAUNDICE is *an obſtruction of the gall duct*. This duct is of the ſize of a crow quill. It may be obſtructed,

Causes.	Remedies.
1. by *ſpaſm*, - - - -	1. Antiſpaſmodics.
2. by *gall ſtones*, - - -	2. The warm bath, emetics, bleeding.
3. by *viſcid mucus*, - - -	3. Alkaline remedies.
4. by *hardened feces*, - - -	4. Laxatives.
5. by *an induration of the liver*, - &c. &c.	5. Small doſes of mercury.

As there are five *cauſes* of this diſeaſe enumerated, no *one remedy* is a ſpecific, applicable to every caſe of jaundice, and it is therefore at leaſt *four* to *one* againſt the patient in the hands of an unſkilful practitioner. This equally applies to every other diſeaſe. Dr. Rowley deſcribes no leſs than ONE HUNDRED and EIGHTEEN *principal diſeaſes* of the *eye*. Neither is *knowledge* ſufficient *of itſelf*: for I doubt much whether even Sir Isaac Newton would have ſupplanted the ſimple *ſteerſman* in the conduct of a veſſel.

If *freſh air*, continues this benevolent, but unphiloſophic writer, be neceſſary for perſons in health, it is ſtill more ſo for ſuch as labour under diſeaſe, who often loſe their lives by thoſe methods, which an over anxious care too frequently contrives in the chambers of the ſick. The notion that *their* rooms muſt be kept very cloſe, is ſo common that *we* can hardly enter the chamber, where a patient lies, without being ready to faint, from the *noxious air* in the room. How this muſt act on *the ſick* is left for the diſcerning to judge. To me, it appears, ſays he, that no medicine is ſo beneficial as a *cautious* and *diſtant admiſſion* of *freſh air*. WHEN ADMINISTERED WITH PRUDENCE IT IS THE MOST REVIVING OF ALL CORDIALS.

SECT. VII.

ON EXERCISE.

THIS ſubject has been already conſidered in a philoſophic point of view in Sect. XII. page 126.

It was there ſhewn, that when muſcular intumeſcence took place, certain chemical combinations were formed, productive of the VITAL FLAME.

If I walk ſlowly along, for the ſpace of a quarter of a mile upon even ground, my *breathing* and *pulſe* are but little accelerated, and *the heat* of my body remains nearly the ſame as before. But if I walk at the ſame pace, and for the ſame diſtance, up a *ſteep hill*, or bearing a *heavy burthen*, my *breathing* becomes *ſhort* and *full*, and my *heart* beats *ſtrong* and *quick*, and *the heat* thrown off from my body corresponds with theſe increaſed internal movements.

It is natural to aſk, what is the cauſe of this *difference*, when the *ſpace*, the *ſpeed*, and the *actual movement* of the muſcles are the ſame? It certainly ariſes from the *quantity* of *nervous electricity* tranſmitted from the BRAIN to the muſcles in the *latter caſe*, where the body was *raiſed* on high, or where a *weight* was carried, being *much greater* than when the body is *only moved*, without being lifted up, or without any additional weight upon it. For though the *motion* of the muſcles be the *ſame* in both caſes, yet the *increaſed* weight to be moved, required the *nervous exertion* to be much *greater* in the latter inſtance than in the former; and therefore the *will*, or *determination of the mind*, propelled a *greater quantity* of *nervous electricity*, from the BRAIN to the *muſcles* employed.

To the increaſed demand on the ſyſtem of OXYGEN AIR, to be *decompoſed* by the *nervous electricity* *, the accelerated *reſpiration* muſt be attributed; and from the increaſed quantity of OXYGEN AIR in the blood, we can account for the improved *digeſtion* †, and a more rapid *circulation*; and from all theſe cauſes, concurring with the *electricity* of the nerves, we are able to ſee clearly the reaſon of the increaſe of the *vital flame*.

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* The *oxygen air* thus procured to the blood from the *want* of the ſyſtem, is ſaid to proceed from the *vis medicatrix naturæ*, and by others from *aſſociation* or *ſympathy*. Thus the call of the ſtomach for food after a fever does not ariſe from the ſtimulus of the gaſtric juice, but from *the want* of the ſyſtem. Thus a ſtimulus on the ſneiderian membrane of the noſe occaſions *ſneezing*, &c. &c.

† Vide Sect. VIII. on the Balance betwixt Reſpiration and Digeſtion.

Obſervation 1. If an animal, a man, for inſtance, in good health, be expoſed to a *temperate air*, in a ſtate of *reſt*, the quantity of *vital heat*, generated by the continued attractions of OXYGEN going on in the body, will be ſufficient, with a certain quantity of clothing, for maintaining the temperature of about 97 degrees, by which the ſolids receive their natural ſtimulus, the fluids retain their proper fluidity, and all the functions of life are duly performed, and a ſufficient quantity abounds to carry off the perſpirable fluid.

Obſervation 2. If a man, expoſed to a *froſty air*, continues at reſt, the principles in his body attractive of OXYGEN, cannot generate a ſufficient quantity of *vital heat* to keep every part of the body at its right temperature; becauſe the coldneſs of the ſurrounding medium carries off *the heat* faſter than *they* can produce it; conſequently the ſolids and fluids of the extremities, and at the ſurface of the body, will become frigid, and the fibres torpid, and the death of the extreme, and laſtly of the vital parts, enſue.

Obſervation 3. But, on the contrary, when a man expoſed to a *froſty air*, perceives the coldneſs, and torpor, ariſing from his body being deprived of its heat, faſter than the principles in his body attractive of OXYGEN can furniſh it; if he throws the *voluntary muſcles* into action, the quantity of *heat* generated by the *nervous electricity*, will be ſufficient to warm every part, and recover and maintain the natural temperature; although the air ſhall ſtill continue to withdraw rapidly the *vital heat* from the ſurface of the body.

Some very pleaſing experiments are related by Dr. PEART (whoſe name would be oftener mentioned with *ſtill higher reſpect*, were we fortunate enough to rank him among the many illuſtrious converts to the *new chemiſtry*), which prove that *partial exerciſe* conveys *a glow* over the *whole body*.

1. EXPERIMENT.

I put my hand, ſays he, firſt into cold water at 56 degrees of temperature. After fifteen minutes I withdrew it, and found the temperature of the water raiſed to 65.

It had gained therefore, in fifteen minutes, 9 degrees of heat.

2. EXPERIMENT.

The ſame day I put my hand as before, but inſtead of keeping it, and my body, in a ſtate of perfect reſt, I threw many of the voluntary muſcles into action, and in fifteen minutes the water at 56 degrees was raiſed to 73.

Here it had gained 17 degrees of heat.

3. EXPERIMENT.

To prove that the exertion of any ſet of muſcles affects the quantity of heat generated within, and thrown off from the whole body, I introduced my hand into the ſame quantity of water, and at the ſame temperature as in the firſt experiment, and I puſhed my feet againſt a large book-caſe, firmly fixed by its own weight, and my arms were forcibly ſtretched out. By the exertion of theſe few muſcles only, without any motion of the fibres, ſo much of the *electric fluid*[*] was tranſmitted to theſe parts, and ſo much *heat* diſengaged that *its ſtimulus* extended over the *whole body*, and the water in fifteen minutes roſe in conſequence to 14 degrees, that is, five degrees more than where the body was in a ſtate of perfect reſt[†].

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[*] Dr. PEART has the *nervous fluid.*

[†] The ſame is proved, though not quite ſo philoſophically, by the vulgar mode of warming the *body* by throwing the *arms* acroſs, or by the more elegant, but partial, exerciſe of what are called *dumb bells.*

To ſhew the abſolute neceſſity of EXERCISE in *cold climates*, I muſt beg leave to relate the botanical excurſion of Dr. SOLANDER, Sir JOSEPH BANKS, and others, on the heights at *Terra del Fuego*. Dr. SOLANDER, who had more than once croſſed the mountains which divide *Sweden* from *Norway*, well knew that *extreme cold* produces a torpor and ſleepineſs almoſt irreſiſtible, he therefore conjured the company to keep always IN MOTION, whatever pain it might coſt them, and whatever relief they might be promiſed by an inclination to reſt: "*Whoever ſits down*, ſays he, *will ſleep*; *and whoever ſleeps, will wake no more.*" Thus, at once admoniſhed and alarmed, they ſet forward; but while they were ſtill upon the naked rock, and before they had got among the buſhes, the cold was ſo intenſe, as to produce the effects that had been moſt dreaded. Dr. SOLANDER himſelf was the *firſt* who found the inclination, againſt which he had warned others, irreſiſtible; and inſiſted upon being ſuffered to lie down. Mr. BANKS (now Sir Joſeph Banks) intreated and remonſtrated in vain: down he lay upon the ground, though it was covered with ſnow; and it was with great difficulty that his friend kept him from *ſleeping*. One of his *black ſervants* alſo began to linger, having ſuffered from the cold in the ſame manner as the Doctor. Partly by perſuaſion, and partly by force, the company made them go forward. Soon, however, they both declared "they would go no farther." Mr. BANKS had recourſe again to intreaty and expoſtulation, but theſe produced no effect: when the black was told, that if he did not go on he would in a ſhort time be frozen to death; he anſwered, *that he deſired nothing ſo much as to lie down and die*; the Doctor did not ſo explicitly renounce his life; he ſaid he would go on, but that he muſt firſt take ſome "*ſleep*," though he had before told the company that "*to ſleep was to periſh.*" They both in a few minutes fell into a profound ſleep, and after five minutes Sir JOSEPH BANKS happily ſucceeded in waking Dr. SOLANDER, who had almoſt loſt the uſe of his limbs, and the muſcles were ſo ſhrunk, that his ſhoes fell from his feet; but every attempt to relieve the unfortunate black proved unſucceſsful.

It was a principle among the ancients, that *acute diſeaſes* are from heaven, and *chronical* from ourſelves; to die, ſays Dr. JOHNSON, is the fate of man, but to die with *lingering anguiſh* is generally his own folly. *Inactivity* never fails to induce an univerſal relaxation of the contractile fibres. When theſe fibres are relaxed, neither the *digeſtion*, the *circulation*, nor the *periſtaltic motion*, can be duly performed.

It is abſolutely impoſſible to enjoy health, where the *perſpiration* alſo is not duly carried on; and that can never be the caſe where *exerciſe* is neglected.

The neceſſity of *action* is not only demonſtrable from the fabric of the body, but evident from the obſervation of the univerſal practice of mankind, who for the preſervation of health in thoſe, whoſe rank or wealth exempts them from the neceſſity of lucrative labour, have invented ſports and diverſions, though not of equal uſe to the world with agricultural employments, yet of equal fatigue to thoſe who practiſe them, and differing only from the drudgery of the huſbandman, as they are acts of choice, and therefore performed without the painful ſenſe of compulſion. The huntſman riſes early, purſues his game, through all the dangers and obſtructions of the chace, ſwims rivers, and ſcales precipices, till he returns home, no leſs haraſſed than the ſoldier, and has, perhaps, ſometimes incurred as great hazard of wounds or death: yet he has no motive to excite his ardour; he is neither ſubject to the commands of a general, nor dreads any penalties for neglect and diſobedience; he has neither profit nor honour from his perils and his conqueſt, but toils without the hopes of mural or civil garlands, and muſt content himſelf with the praiſe of his tenants and companions.

But ſuch is the conſtitution of man, that *labour* may be ſtyled its *own reward*; nor will any *external excitements* be requiſite, if it be conſidered *how much happineſs is gained*, and *how much miſery eſcaped*, by frequent and violent agitation of the body.

The deſire of *exerciſe* is *coeval* with life itſelf. Were this principle attended to, many diſeaſes might be avoided. But, while *indolence* and *ſedentary* employments prevent two thirds of mankind from either taking ſufficient exerciſe themſelves, or giving it to their children, what have we to expect but diſeaſe and deformity? The *rickets*, ſo deſtructive to children, called by the *French* the *Engliſh diſorder*, never appeared in BRITAIN till manufactures began to flouriſh, and people, attracted by the love of gain, left the country to follow *ſedentary* employments in great towns *.

Every animal makes an early uſe of its organs of motion; and many young creatures, even when under no neceſſity of moving in queſt of food, cannot be reſtrained without force. This is evidently the caſe with the calf, the lamb, and the kitten. If theſe harmleſs animals were not permitted to *friſk* about and *take exerciſe*, they would ſoon die, or become diſeaſed; and ſo ſtrong is this *principle* implanted in the human breaſt, that a healthy youth can hardly be kept from exerciſe. This love of motion is ſurely a ſtrong proof of its *utility*. Nature implants no diſpoſition *in vain*. It ſeems a catholic law throughout the whole brute creation, that no creature, without *exerciſe*, ſhall be able to find ſubſiſtence. Every creature, except man, takes as much exerciſe as his nature requires. He alone ſleeps till late in the morning in beds of down, and often lolls all day in eaſy chairs, and, deviating from the great law of his Creator, he ſuffers accordingly.

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* Dr. BUCHAN.

If faſhion muſt prevail, and young children be ſent to *crowded* ſchools, we would recommend it to their teachers, as *they value the lives of thoſe entruſted to their care*, and *the account they muſt one day give*, that they would allow their pupils a ſufficient time to *run* and *friſk* about, inſtead of keeping them HOUR AFTER HOUR in cloſe and irkſome confinement, which ſubjects them to a dreadful train of diſeaſe, flatulence, indigeſtion, colics, worms, &c. &c. and hinders them hereaſter from being *happy* and *uſeful* members of ſociety. From *this criminal folly*, ſays the emphatic Dr. Johnson, proceed moſt of thoſe pains which wear us away ſlowly with periodical tortures, and which, though they ſometimes ſuffer life to be long, condemn it to be uſeleſs, chain us down to the couch of miſery, and mock us with the hopes of death.

Certainly man was never deſigned to be ſitting all day *croſs-legged* on a board. The *maſter*, who denies a ſufficient time for *exerciſe* to thoſe unhappy beings, whom Providence has ſubjected to his will, has a dreadful reckoning to make, when each individual ſhall receive from the *ſame meaſure* he has meted out to others.

Were ſedentary employments intermixed with a due quantity of exerciſe, they would never do much hurt. It is conſtant confinement that ruins health. A man will not be injured by ſitting at his work three or four hours at a time; but if he be *obliged*, by an *unfeeling maſter*, to ſit eight or ten, he will ſoon be ſaid to drag on life inſtead of enjoying it. Weak and ailing he will languiſh out a few miſerable years, and at laſt ſink into an untimely grave.

Weak fibres are the conſtant companion of *inactivity*. Nothing but daily *exerciſe* in the *open air* * can brace and ſtrengthen the powers of the *ſtomach*, and prevent therefore an endleſs train of diſeaſes, which proceed from a relaxed ſtate of that organ. We ſeldom hear the active or laborious complain of what are called *nervous diſeaſes*; theſe are reſerved for the ſons of idleneſs. Many have been completely cured of theſe diſorders by being reduced, from a ſtate of opulence, to labour for their daily bread. This plainly points out the ſources from whence *nervous diſeaſes* flow, and the means by which they may be prevented †.

Dr. CHEYNE, in his excellent Treatiſe on Health, ſays, that the weak and valetudinary ought to make EXERCISE *a part of their religion*. We would recommend this, not only to the weak and valetudinary, but to ſedentary artificers, ſhopkeepers, ſtudious perſons, &c. &c. Such ought to conſider *exerciſe* as neceſſary *a duty* as to

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* The *oxygenation of the blood* has been before ſhewn to be one of the great reaſons for the neceſſity of daily *exerciſe*, and this will be ſooner and better effected the *purer the air*. Dr. BEDDOES, after breathing each day ſome pure OXYGEN AIR, ſays he felt himſelf not only warmer, but *certainly* more *diſpoſed towards*, and *capable of*, MUSCULAR EXERTION. Vide his Letter to Dr. DARWIN.

† Dr. BUCHAN.

take food; and this might be uſually done without any great loſs of time or interruption to buſineſs.

Every man, in ſhort, ſhould oblige himſelf by ſome abſolute rule to engage in *daily exerciſe*. *Indolence*, like other vices, when indulged, gains ground, and at length becomes agreeable. Hence many who were fond of *exerciſe* in the early part of life, become quite averſe to it afterwards. Diſeaſes are engendered deſtructive of the reſolution of the mind. Nauſeous drugs are had recourſe to. The ſtimulus at the ſtomach ſpreads its influence for a time over the whole body. It at laſt loſes its efficacy, or becomes prejudicial, and the *pale*, *flatulent*, and *bloated hypochondriac*, flies from phyſician to phyſician, none of whom dare adviſe him EXERCISE, which he is averſe to, and ſays he cannot take, and he falls at laſt into diſeaſes of a more ſerious aſpect, and dies of ſpaſm in the ſtomach, or dropſy, or aſthma, or jaundice, or a cough with mucous expectoration, or palſy, or hæmoptoe, or ſome other diſeaſe that either ariſes from, or is always *engrafted* upon, a *weak* and *debilitated frame* *.

I ſhall conclude this long but *uſeful* eſſay with ſome beautiful lines from AKENSIDE, whoſe poem, entitled

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* Vide BROWN's Elements.

the Art of Preſerving Health, might have poſſibly promoted the *diſcoveries* of the late Dr. BROWN.

> The ſhades deſcend, and midnight o'er the world
> expands her ſable wings. Great NATURE droops
> through all her works. How happy he whoſe *toil*
> has o'er his languid powerleſs limbs diffus'd
> a *pleaſing laſſitude.* He not in vain
> invokes the gentle deity of dreams.—
> *By toil ſubdu'd,* the warrior and the hind
> ſleep *faſt* and *deep*:—THEIR ACTIVE FUNCTIONS SOON
> WITH GENEROUS STREAMS THE SUBTLE TUBES SUPPLY[*].
> Ere morn the *tonic irritable nerves*
> feel the freſh impulſe, and awake the ſoul.

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[*] Vide Law III. *The Accumulation of Excitability.*

SECT. VIII.

ON FOOD.

At firſt, the food taken into the ſtomach retaining its peculiar properties, *irritates* the inner coat of that organ, and occaſions a contraction of its two orifices. The food, thus confined, then undergoes a conſtant agitation by means of the abdominal muſcles, and of the diaphragm, and by the motion of the fibres of the ſtomach itſelf. By theſe movements, every part of the food is expoſed to the action of a fluid ſecreted in the ſtomach, called *the gaſtric juice*, which (as water diſſolves ſugar) gradually diſſolves and attenuates the food (as preſently will be proved *), and prepares it for its paſſage into, and farther change in, the inteſtines.

The painful ſenſation of *hunger*, which is the irritation of the gaſtric juice on the inner coat of the ſtomach, or the ſenſation of a defective ſupply of chyle in the arterial ſyſtem †, being removed by the food, we ſoon feel a mild a mild and undeſcribable delight, firſt from the ſtimulus of the aliment; and ſecondly, from the diſtenſion of this, and the increaſed action of other parts *.

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* Vide Sect. IX.

† Nothing better illuſtrates this, than what happened to Admiral **Byron**, Captains **Cheat** and **Hamilton**, when ſhipwrecked on the weſt coaſt of South

If it ſhould ſeem ſtrange that *pleaſure* ariſes from *the ſtimulus* of food on the ſentient nerves of this important organ, let us recollect only the effect of a moderate doſe of *opium* to thoſe unaccuſtomed to *that ſtimulus.* They are commonly ſo tranſported with the pleaſing ſenſation it induces, that they feel, as they oftentimes expreſs themſelves, as though they were in heaven, and enjoy ſo perfect a pleaſure, that no happineſs in the world can ſurpaſs the charms of this agreeable ecſtaſy. On the other hand, what a terrible agony will two or three grains of *crocus metallorum* throw the whole fabric into; this part being of ſo acute a feeling, that ſome philoſophers have for this reaſon thought it to be the ſeat of the ſoul itſelf.

Beſides this conſideration, we muſt here take notice,

South America; who, after ſuffering months of hunger and fatigue, were reduced to ſkin and bone. A table, ſays **Byron**, was ſpread out for us by the Indians, with cold ham and fowls, which only we *three* ſat down to, and in a ſhort time we diſpatched more than *ten* men with common appetites would have done, and yet we complained of being *unſatisfied.* For a long while we got up two or three times in the night to cram ourſelves. Captain **Cheat** uſed to declare, that he was quite aſhamed of himſelf.

* Vide Law II.

that the ſtomach, being diſtended with food, preſſes on *the ſpleen*[*], and thereby occaſions a greater quantity of blood to paſs into the *pancreas*, and conſequently a greater increaſe of the ſecretion from that viſcus;—and by obſtructing in ſome degree the paſſage of blood in the deſcending trunk of the *aorta*, cauſes an increaſed flux of blood to the *head*, and hence, after a full meal, inactivity and drowſineſs[†], and ſometimes apoplexy[‡], enſue; and hence alſo proceed thoſe fluſhings or redneſs in the face, ſo conſpicuous in weak and exhauſted perſons.

The increaſed *oxygenation of the blood* from the ſame circumſtance has been before noticed, when on the ſubject of ANIMAL HEAT, and *the balance*, that is conſtantly found to take place, betwixt the *hydrogen* received in the ſtomach, and the *oxygen air* drawn into the blood while paſſing through the lungs. Probably, from this cauſe it was, that more of Sir JOSEPH BANKS and Dr. SOLANDER's party did not periſh at *Terra Del Fuego* *. Hence the importance of the conſideration of food † in all inflammatory ſtates of the body. And hence the conſideration of a peculiar diet for the removal of many diſorders incident to the human frame.

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[*] The true office of the SPLEEN was *the happy diſcovery* of the ingenious Dr. HAIGHTON, Lecturer on Phyſiology to the Pupils of Guy's and St. Thomas's Hoſpitals. It did not eſcape the penetrating mind of the Reverend Mr. TOWNSEND, and this coincidence of thought is a further proof of its truth. See *the Guide to Health*, page 33. Vide note †, page 215.

[†] Mr. BRINDLEY, the famous canal engineer, mentioned to Dr. DARWIN that he had more than once ſeen the experiment of a man extending himſelf acroſs the large ſtone of a corn-mill, and that by gradually letting the ſtone whirl, the man fell faſt *aſleep*. Dr. DARWIN.

[‡] See *the Guide to Health*.

We will now attempt to trace the food in its digeſted form, after it is thrown out from the ſtomach into *the inteſtines*.

The aliment having remained during two or more hours in the ſtomach is converted, firſt, into a greyiſh pulp,

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[*] They had with them a bottle of *rum*, and a ſailor, who was ſeized as bad as the black, recovered from *his torpor* by drinking of the rum. Vide *Cook's Voyages*. See alſo the Section on *Animal Heat*, page 81.

[†] Mr. SUTTON, in the vicinity of Plymouth, inoculated a lady, who on the third day after the commencement of the irruptive fever, had five or ſix red pimples, which formed gradually into puſtules.

During the progreſs of the diſeaſe, as ſhe ſat at table, ſhe expreſſed uneaſineſs, and wiſhed to have ſtronger evidence, than yet appeared, that ſhe had the ſmall-pox. Mr. Sutton told her, that ſhe had only to eat a portion of hare, which was on the table, and drink one glaſs of wine, and ſhe would have ſufficient evidence to ſatisfy her mind.

She accepted the propoſal; the fever increaſed; and the ſmall-pox, from being *diſcrete*, became *confluent*.

Mr. Sutton then took fright, and delivered her to the care of Drs. Mudge and Huxham, by whoſe watchful attention ſhe was carried ſafely through the ſecondary fever. Vide *the Guide to Health*, page 156.

pulp, which is uſually called *chyme.* This chyme, or fluid, paſſes out of the *pylorus*, or right orifice of the ſtomach, the fibres of which relax to afford it a paſſage; while the groſſer and leſs altered particles remain in *the living retort*, to adopt the expreſſion of the Reverend Mr. TOWNSEND, till they acquire a ſufficient fluidity to paſs into the inteſtinal canal. As the digeſted food enters the *duodenum* *, it ſtimulates the common duct of the *gall bladder* and the *liver*, and from a law in the animal œconomy, which has given the higheſt ſenſibility to the nerves at the mouths of the ſeveral ducts, which, by a ſympathetic communication, occaſions their ſeveral glands either to ſecrete or pour out a greater quantity of fluid, *the chyme* receives a full ſupply of *bile*, and of *ſaliva*, ſecreted from the *pancreas* †; it alſo intermingles with *mucus* from innumerable exhalent arteries, which ſtill farther anamalizes the chyme.

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* The commencement of the inteſtines.

† The *pancreas* is a large gland, which lies near the ſtomach, and diſcharges, by a ſhort duct, into the inteſtines, a liquor, which it ſeparates from the blood. It is difficult to collect any quantity of this juice, becauſe it is not lodged in any particular receptacle, but flows from the gland into the inteſtines, near the upper orifice of the ſtomach. However, in dogs this has been executed by tying a bottle near the duct of the gland, while the animal was living, by which a quantity of the juice has been collected, and found in appearance to reſemble the *ſaliva.*

The *inteſtinal canal* is five or ſix times as long as the body, and forms many circumvolutions in the cavity of the abdomen, which it traverſes from right to left, and again from left to right. The inner coat of the inteſtines, by being more capacious than their exterior tunics, occaſions a multitude of *plaits* *, at certain regular diſtances from each other, and theſe become leſs and leſs, and at farther intervals, as they deſcend. This diſpoſition will be found to afford a ſtill farther proof of that divine wiſdom, which the anatomiſt and phyſiologiſt cannot fail to obſerve in all their purſuits; for if the inteſtinal canal was much ſhorter than it is; and if its inner ſurface was ſmooth and deſtitute of plaits; the aliment would conſequently paſs with great rapidity to its termination, and ſufficient time would be wanting to aſſimilate the chyme, and for the neceſſary abſorption of it by the numerous *villi*, or hair-like projections †, which terminate in *lacteals*: ſo that the body, unleſs conſtantly repleniſhed, would be deprived of the ſupply of nutrition, which is ſo eſſential to life and health:—but the length and circumvolutions of the inteſtines, the inequality of their internal ſurface, and the courſe of the

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* Called by anatomiſts *valvulæ conniventes.*

† Vide the Section on *Animal Heat,* and note *, page 87.

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aliment through them, all concur to perfect the ſeparation of the chyle from the fæces, and to afford the neceſſary nouriſhment * to the body.

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* Mr. BELCHER happening to dine at a callico printer's, was ſurpriſed to find the bones of the pork at table of a very red appearance. They had eat *madder*. This eminent ſurgeon mixed that ſubſtance with different foods, and gave it to fowls, and other animals, and a ſimilar change of colour in all the bones, and even in the teeth, took place: but, after a certain time, if theſe were fed on food containing no *madder*, the bones *regained* their natural appearance. To prove that the different parts of the body are renewed, JOHN HUNTER fed two ducks, the one with *barley*, the other with *ſprats*, for about a month, and killed both at the ſame time. When they were dreſſed and ſerved at his table, that fed wholly with *ſprats* was *hardly eatable*, it *taſted ſo ſtrongly of fiſh*. Theſe facts prove, that our fabric is ever being pulled to pieces and renewed; that the matter is continually changed, though the ſame *identity* remains! They alſo prove that our body may be compoſed of parts *unaſſimilated*, though *changed* by the wonder-working powers of the body from *inanimate* to *animate matter!*

SECT. IX.

OF THE GASTRIC SOLVENT, AND THE RELATIVE DIGESTIBILITY OF FOOD.

In ſerpents, ſome birds, and ſeveral kinds of fiſh, which ſwallow whole animals, and retain them long in their ſtomach, *digeſtion* ſeems to be performed, ſays Cheselden, by *ſome unknown menſtruum*; for we frequently find in their ſtomachs animals ſo totally digeſted, *before their form is deſtroyed*, that their very *bones* are made *ſoft*. One may indeed draw very plauſible inferences concerning human digeſtion, from obſervation on other ſpecies of animals, eſpecially from birds of prey, the cat and dog, which reſemble us ſo much in the ſtructure of the ſtomach. But analogical arguments are *probable* indeed, but not *concluſive*. And it is an object of much higher importance to attain *certainty* in man than in animals. In the writings of ancient and modern phyſicians no topic is more frequently diſcuſſed, yet there is little elſe beſide *ſuppoſition*: direct experiments upon *man* are entirely wanting, and their reſearches are illuminated only by the *twilight* of conjecture, and ſupported by *precarious hypotheſis.* Upon reflection, ſays the celebrated SPALLANZANI, it appeared that direct experiments might be made on man, and for this purpoſe it was neceſſary to ſwallow tubes full of various vegetable and animal ſubſtances, in order clearly to aſcertain *the changes* they undergo in the ſtomach. I will candidly own, ſays he, that this experiment gave me at firſt ſome apprehenſion. The hiſtories of indigeſtible ſubſtances occaſioning troubleſome ſymptoms, and being vomited up after a conſiderable time *, occurred to my imagination. I alſo recollected inſtances where ſuch bodies had ſtopped in the alimentary canal †. Other facts however, where the reſult was contrary, and of more frequent occurrence, gave me alſo ſome confidence. Thus we every day ſee the ſtones of cherries, medlars, plums, &c. ſwallowed and voided with impunity. This conſideration at laſt determined me to make the trial with as great caution as poſſible.

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* Vide Baron HALLER, T. 6.

† Dr. COE, in his Treatiſe on Biliary Concretions, gives an inſtance of a woman, from whoſe rectum was extracted a concretion, the nucleus of which was a *plum-ſtone.* In the Edinburgh Medical Eſſays, we have an account of a ſimilar fact. In the Eſſays and Obſervations, Phyſical and Literary, there is the hiſtory of a boy who had three ſtones extracted from the rectum, the nuclei of which were the ſmall bones of *ſheep's trotters.* In the Philoſophical Tranſactions, we have an account of a concretion formed upon a *plum-ſtone,* and retained in the blind gut: and in the London Medical Journal, Mr. JOHNSON relates the caſe of a woman, who paſſed a ball of hardened fæces, weighing three quarters of an ounce, the nucleus of which was a *plum-ſtone.*

I ſwallowed, in the morning faſting, a linen bag, containing 52 grains of *maſticated bread.* I retained the purſe 23 hours without experiencing the ſmalleſt inconvenience, and then voided it quite *empty.* The ſtring uſed for ſewing and tying it was entire, nor was there any rent in the bag itſelf. The fortunate reſult of this experiment gave me great encouragement to undertake others.

From *vegetable* I proceeded to *animal* ſubſtances. In a ſimilar bag 60 grains of *boiled veal* were encloſed, previouſly maſticated. The purſe was voided in 18 hours and three quarters, and the fleſh was *conſumed.* Only a few fibres remained, and theſe were void of ſucculency, as if they had been ſet under a preſs.

My next experiments were made to ſee, whether digeſtion was accompliſhed or aided by a *triturating power* in the ſtomach.

Boerhaave, neither ſatisfied with the ſyſtem of digeſtion in the human ſtomach by heat, as ſuggeſted by *Galen,* and adopted by his followers; nor yet better pleaſed with attributing this proceſs to the vital energy of the ſoul reſiding in the ſtomach, as conceived by the fertile imagination of *Van Helmont*; invented a ſyſtem of his own, in which he attributes the digeſtion of our food partly to *fermentation*, but principally to *triture*, *preſſure*, and *powerful quaſſation*. He deſcribes the folds of the ſtomach as grinding the more ſolid parts of the aliment; and, to aſſiſt in this proceſs, he calls in the aid of its external coat, with the diaphragm, and the numerous muſcles of the abdomen. Not ſatisfied with theſe, he takes into his account the violent pulſations of the ſubjacent aorta, with the vibrations of innumerable ſurrounding arteries, which he eſtimates at no leſs than three thouſand ſix hundred pulſations in the hour.

This diſtinguiſhed phyſician reaſoned from analogy, and took particular notice of the *oſtrich*, which he had obſerved to ſwallow pieces of iron and of glaſs, evidently for the purpoſe of triture, becauſe the ſound of *grinding* was perceptible to thoſe who liſtened.

In the *graniverous birds* he had remarked, beſide the crop, furniſhed with ſalivary glands to mollify their food, a gizzard, or ſecond ſtomach, provided with ſtrong muſcles to *triturate* the grain; and the avidity with which they ſwallow gravel to aſſiſt the operation had not eſcaped his notice. Having examined the ſtructure of the *lobſter*, he ſaw at the mouth of the ſtomach a curious mechaniſm, *three teeth*, of which *one*, moved by a ſtrong muſcle, *triturates* the food againſt *the other two.*

In the larger *crawfiſh* of the ſea, he might have noticed a ſtructure ſomewhat different, where to anſwer the ſame intentions, inſtead of *three teeth*, we obſerve a *peſtle* ſupplied with a ſtrong muſcle and placed between *two mortars.*

No wonder, then, that this great mechanic on the ſubject of digeſtion had mechanical ideas.

To prove that digeſtion in the human ſtomach is not aided by triture, I was under the neceſſity, ſays SPALLANZANI, of ſwallowing thin tubes. Theſe tubes were voided in about 22 hours. Among the tubes employed in theſe experiments I procured ſome to be made ſo *thin* that the ſlighteſt preſſure would have cruſhed them to pieces, or have bent in their *edges*; but though I frequently uſed them, *not one was ever broken*, nor on examination could I perceive the *ſmalleſt fiſſure.*

Having thus eſtabliſhed this fundamental propoſition, viz. THAT DIGESTION IS PRODUCED BY THE GASTRIC FLUID INDEPENDENTLY OF TRITURATION, I had before me, ſays he, a fine field for experiments, which could not fail to ſuggeſt ſome important truths.

The neceſſity of maſtication deſerves to be well known. There is, perhaps, no perſon who has not ſome time or other been ſubject to indigeſtion for want of having chewed ſufficiently his food. I took *two* pieces from a pigeon's heart, each weighing *forty-five* grains, and having *chewed one* as much as I uſed to chew my food, encloſed them in two ſpheres, and ſwallowed them at the ſame time. Both theſe tubes happened to be voided at the ſame time, and I then ſaw *how much digeſtion is promoted by maſtication.* Of the *maſticated fleſh* there *remained only* 4 *grains*, whereas of *the other* there were 18 *left.* This was confirmed by two other experiments, one made with *mutton*, the other with *veal.* The reaſon of this is obvious. Not to mention the ſaliva which moiſtens and attenuates the food, it cannot be doubted, that when it is reduced to pieces by the action of the teeth, the *gaſtric juice* meets it at all points, and therefore the more ſpeedily diſſolves it, juſt as other menſtrua diſſolve ſooneſt thoſe bodies that have been previouſly broken into fragments*.

I now wiſhed to make ſome experiments with the gaſtric fluid *out of the body*. A ſufficient quantity could not be obtained by killing birds and other animals, and it became neceſſary to invent a contrivance for obtaining it from them alive. Three tubes containing *ſpunge* were therefore introduced into the ſtomach of a crow, and after four hours theſe were vomited up. The pieces of ſpunge being ſaturated with the fluids of that cavity, were then taken out and preſſed between the fingers. Theſe afforded 37 grains of *gaſtric liquor* of a tranſparent yellow colour, poſſeſſing a ſomewhat bitter and ſaltiſh taſte.

I now attempted, ſays the ABBÉ, to produce *artificial digeſtion* with the gaſtric juice thus obtained.

It was January, and Fahrenheit's thermometer, placed near the veſſel uſed for the experiment, ſtood at 42 and 43 degrees. For greater certainty in theſe experiments, I eſtabliſhed a term of compariſon, by employing ſimilar veſſels, containing the ſame fleſh, infuſed in water. I alſo took care, upon the preſent occaſion, that the fleſh ſhould be completely immerſed in their reſpective liquors, and that the phials ſhould be cloſed with ſtopples. *For ſeven days the fleſh kept in the gaſtric juice, and in water continued the ſame.* On the eighth I perceived, ſays SPALLANZANI, a ſlight ſolution, for upon agitating both liquors, ſeveral particles ſeparated from the larger maſs, and fell down to the bottom of the phials. No further progreſs was afterwards made, and the gaſtric fluid did not ſeem at all more efficacious than common water; only the fleſh immerſed in the former *in a ſurpriſing manner was preſerved from* PUTREFACTION. In this experiment I had uſed beef; I verified the ſame obſervation upon the more tender fleſh of calves, chickens, and pigeons; the temperature of air was about 48 degrees of Fahrenheit's thermometer. — While I was making theſe experiments in the natural temperature of the air, I was employed about others of a like nature in a *warmer medium*, viz. in a ſtove, in which the heat varied from 79 degrees to 80 of heat. *And now the effects produced by the gaſtric fluid, greatly differed from thoſe produced by water.* In the latter the fleſh began to be a little diſſolved in two days; this was the effect of incipient putrefaction from heat and moiſture *. The

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* Vide what has been ſaid page 219.

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* Vide page 151, line 11.

fœtid ſmell continued to increaſe during the following day, and in a week became intolerable, when the fleſh was reduced to a nauſeous pulp. *In the gaſtric juice the ſolution was more rapid, and exhibited very different phænomena; twenty-five hours were ſufficient to decompoſe the fleſh contained in it, and in a little more than two days there remained only a very ſmall morſel entire.* Theſe ſolutions never emitted any *bad ſmell*; whence it is evident, that they did not ariſe from incipient putrefaction, like thoſe in water, but from a more efficacious and a different menſtruum, viz. the GASTRIC LIQUOR*.

To Edinburgh there came by accident a huſſar, a man of weak underſtanding, who gained a miſerable livelihood by ſwallowing pebble-ſtones, and chewing flints †, for the amuſement of the common people. The ſtomach of the *ſtone-eater*, as he choſe to ſtyle himſelf, was ſo much diſtended, that he was able to ſwallow a great number of pebble-ſtones during the day ; and theſe might be plainly felt, and be *chinked*, if you preſſed forcibly with your hand below the ſhort ribs on the left ſide.

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* This is a very important experiment, and confirms what has been before ſaid, when treating on ANIMAL HEAT, and the balance betwixt DIGESTION and the OXYGENATION OF THE BLOOD. Vide p. 91.

† His front teeth were *filed down*, and he had the art of ſplitting into pieces *flint ſtones*, by ſtriking them with his fore-teeth in a *particular direction*, juſt as they faſhion *flints* for guns. *Theſe pieces* he would ſhew to his aſtoniſhed viſitants, put them under his tongue, and pretending to have ſwallowed them, he would then proceed actually to gulp down ſome *ſmooth pebble-ſtones*, which he took care to have by him on the table.

Dr. STEVENS tried many experiments, ſimilar to thoſe above related, with this man, who ſwallowed ſilver ſpheres, which were perforated ſo fine as hardly to admit a needle into each opening, and he always found the food that he encloſed in theſe bodies diſſolved. He next turned his attention to the different degrees of *ſolubility* ; or, as it was formerly called, to the *hard* or *eaſy digeſtion* of *different ſubſtances*, and the reſult of his experiments are equally curious as important.

Having procured a whelp five months old, it was kept faſting ſixteen hours, and four of the globes, as uſed in the foregoing experiments, each containing a like quantity of food, were forced into its ſtomach. The ſubſtances had been previouſly cooked, and weighed each 16 *grains*. Seven hours afterwards the animal was killed, and the globes were taken out of the ſtomach ; when the *beef* was found to have loſt 10½ grains, the *mutton* 6 grains, the *potato* 5 grains, the *fowl* 4 grains, and the *parſnep* 0.

To another dog that had faſted twelve hours I gave, ſays he, 16 grains of *roaſted beef*, in a ſecond ſphere the ſame quantity of *veal*, in a third only *fat*, and in a fourth *wheaten bread*. In ten hours the animal was killed and opened, and the tubes were taken out of its ſtomach. The *beef* and *bread* were quite diſſolved; the *veal* had loſt only 10 grains, and the *fat* 8½ grains.

As in the laſt experiment the *veal* was not ſo ſoon diſſolved as the *beef*, I began, ſays he, to ſuſpect that the fleſh of *young animals* in general is leſs eaſy to digeſt than *that of old ones*. I therefore took care to repeat the experiment with *lamb* and *mutton*, which were put in equal quantities into two tubes. The reſult was as before. In ſeven hours the *mutton* was *quite diſſolved*, whereas the *lamb* had loſt only 10 *grains*.

Having kept a dog faſting eighteen hours, that his ſtomach might be free from the remains of food, I killed it, and collected about half an ounce of pure gaſtric fluid, which was put into ſeparate phials. I then made trial of *mutton*, *veal*, *lamb*, *chicken*, and other *animal* and *vegetable ſubſtances*, and imitating the heat of the ſtomach, they were all readily diſſolved; but the time requiſite for the completion of this proceſs was different, and anſwered exactly *to the reſults of the preceding experiments* [*].

The *huſk* of the ſeeds of plants appears to be indigeſtible in its natural ſtate; whether this ariſes, ſays the celebrated JOHN HUNTER, from the *nature of the huſk* itſelf, or from its *compactneſs* [†], I am not certain, but am inclined to *ſuppoſe the laſt*; as we find the *cocoa*, which is only a huſk, to be digeſtible, when ground to a powder and well boiled. We know, likewiſe, that cuticle, horn, and bone, although animal ſubſtances, are not affected, in the firſt inſtance, by the gaſtric juice; yet if reduced in PAPIN's digeſter [‡] to a jelly,

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[*] We are apt to imagine, that *hard* ſubſtances are more difficultly diſſolved than *ſoft*, but a little attention ſhews us that *the menſtruum* being adapted to the ſubject, *hardneſs has nothing to do in it:* OIL OF VITRIOL diſſolves *ſteel*, and yet does not touch *wax*, and OIL diſſolves *wax*, and does not touch *iron*; and ſo in a thouſand inſtances. Nurſes call *lamb* harmleſs only from the nature of the animal. Dr. SHEBBEARE.

[†] This doubt, the author of the preſent work would have anſwered himſelf by experiment, but having felt the tortures of pain, he could not bear to inflict death on any animal incapable of doing him an injury from its nature, unleſs where the importance of the ſubject had juſtified, or rather had demanded, the cruelty.

[‡] The advantage of PAPIN's digeſter is to give *boiling water* a greater heat than it is capable of naturally having. To do this, the vapour muſt not be ſuffered to eſcape. The lid is ſo contrived as to open inwards, that the ſteam may not force its way out. There is a ſtopple, however, on the lid,

that jelly can be acted upon in the ſtomach; we muſt therefore ſuppoſe that a certain natural degree of ſolidity in animal and vegetable ſubſtances render them indigeſtible. This compactneſs in the huſk ſeems to be intended to preſerve, while under ground, the farinaceous part of the ſeed, in which the living principle is placed; the huſk having probably no other power of reſiſting putrefaction than what ariſes from its texture. Of twenty-five ripe grapes, which SPALANZANI ſwallowed, by way of experiment, eighteen were voided *entire*, of the other ſeven the *ſkins* only appeared. He made the ſame experiments with cherries, and currants, as well ripe as unripe, and by far the greater number were voided *entire*. Although moſt huſks are not capable of being diſſolved in the gaſtric juice, they generally allow of tranſudation; and that the ſeed is in ſome degree affected, is known by its ſwelling in the ſtomach; yet it can only admit by that means a certain portion of the

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to which is fixed the arm of a lever, ſuſpended on a balance. Weights are applied at the end neareſt the ſtopple. Now when the water within is ſo very much heated, that the ſteam *will* force open the ſtopple, and ſo raiſe up the arm of the lever, by knowing what weight is ſuſpended, we can determine exactly the degree of heat. Vide what was before ſaid on the cooling effects of *evaporation*, or the quantity of *caloric* that eſcapes when water is *aerialized* or converted into *ſteam*, page 103.

gaſtric juice, and that not ſufficient to convert it into chyle; therefore we ſee grain when ſwallowed whole, unleſs in birds, whoſe gizzards ſerve them as our teeth, to grind or divide the grain, paſs entire, though much ſwelled; and even the kernels of ſome nuts, as *Spaniſh cheſnuts*, are not digeſtible when eat raw.

But not only *very compact ſubſtances* are difficult of digeſtion, but alſo thoſe that are *fluid* are ſo likewiſe: and we may obſerve, that nature has given us very few fluids as articles of food, and to render the few fitter for the digeſtive powers, a *coagulating principle* is provided to give them ſome degree of ſolidity *.

The LUNGS being deſigned as the organ for *the oxygenation of the blood*, nature has wiſely ordained, *that we ſhall not oxygenate the blood by the ſtomach*, *unleſs it be in thoſe climates*, *where we are oppreſſed by exceſſive heat*; hence in cold climates the evil effects of nitre, of acids, even of punch †, and of what is called a cooling diet:

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* All milk turns in the ſtomach into curds and whey. The property of calves *rennet* is well known. When too much *acidity* prevails in the ſtomach, a little *magneſia* corrects it, and prevents the curd from being *too hard*, and conſequently difficult of digeſtion. It is often proper to dilute milk, in order that the *coagula* may be broken into very ſmall fragments.

† By eating an exotic fruit, ſays Dr. BROWN, which had a mixture of the qualities of the *water-melon*, the *orange* and *lime*, in a quarter of an hour

and hence the neceſſity of condiments when uſing ſuch weak and unwholeſome food.

I had *an attack in my ſtomach* in the middle of my lecture. By means of a *cordial ſtimulus* I repelled it, and went on very well with my lecture.—At other times I have prevented ſuch an effect, by anticipating the remedy.—This doctrine puts much in our power: but we ſhould not therefore play *tricks* with it. On the contrary, we have great reaſon, ſays he, to be thankful for the command it gives us over our health, and that alſo, by the uſe of means not inelegant, nauſeous, and clumſy; but quite the contrary.

One gentleman excepted, ſays Dr. SHEBBEARE, and I never ſaw a gentleman or lady who wholly abſtained from animal food look like other people; nothing is ſo eaſy to diſtinguiſh as a *vegetable man*, by his phyſiognomy, the fitteſt appellation by which they can be diſtinguiſhed; he neither looks, talks, or moves like other people; his face conveys a declaration of his whole body being out of order, by the lifeleſs inſipidity which is in it, as his converſation does of his mind being diſturbed, his whole time being taken up in recounting to the world his manner of living, his feelings, his weak ſtomach, his diſturbed ſleep, his watchings, how he fences out the cold air, what ſhoes and waiſtcoats he has on, and every other ridiculous particularity of his whole life; if he pretends to have ſpirits, it is no more than a certain equability of a lifeleſs inanimate ſtate, like that of the *dormouſe* amongſt animals, or the *yew-tree* in winter amongſt vegetables; the warmth of the one, and the green of the other, *juſt ſhew they are alive*, with *this difference however*, that the ſummer will wake the *two latter* into actual life and motion; whereas, *to the man of vegetables*, the ſummer never comes, that comes to all; and the very power of vegetation and recovery from ſleep, which is beſtowed on the plant and dormouſe, are forbidden him by the regimen he purſues.

SECT. X.

PRACTICAL OBSERVATIONS.

In page 140, when treating of *temperaments*, we remarked that the muſcular fibres of the body, at different periods of life, poſſeſſed different degrees of excitability. This will lead us to conſider the aliment proper for the different ſtages of life.

I. OF THE FOOD PROPER FOR CHILDREN.

Nature not only points out the food fit for infancy, but alſo kindly prepares it. When the babe, ſoon after it is born in this *cold* world, is applied to its mother's boſom, its ſenſe of perceiving *warmth* is firſt agreeably affected; next its ſenſe of *ſmell** is delighted with the odour of the milk; then its *taſte* is gratified by the flavour of it; afterwards the appetites of *hunger* and of *thirſt* afford pleaſure by the poſſeſſion of their objects, and by the ſubſequent digeſtion of the aliment; and laſtly, the ſenſe of *touch* is delighted by the ſoftneſs and ſmoothneſs of the milky fountain, which the innocent embraces with its hands, preſſes with its lips, and watches with its eyes. Satisfied, it ſmiles at the enjoyment of ſuch a variety of pleaſures. It feels an animal attraction, which is love; a ſenſation, when the object is preſent, a deſire, when it is abſent; which conſtitutes the pureſt ſource of human felicity, the cordial drop in the otherwiſe vapid cup of life, and which overpays the fond mother for all her ſolicitudes and care.

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* Any one may obſerve this, when very young infants are about to ſuck; for at thoſe early periods of life, the perfume of the milk affects the organ of ſmell, much more powerfully, than after the repeated habits of ſmelling has inured it to odours of common ſtrength, and the lacrymal ſack empties itſelf into the noſtrils, and an increaſe of tears is poured into the eyes. And in our adult years, the ſtronger ſmells, though they are at the ſame time agreeable to us, as of volatile ſpirits, continue to produce an increaſed ſecretion of tears. Dr. DARWIN.

A calf diſcovers its mother by its ſenſe of ſmell, and each pig has its peculiar teat to which it always goes. What is very remarkable, when a lamb dies, to make the ewe take to another lamb, it muſt be covered for a few days with the fleece of the dead one.

It appears from the annual regiſters of the dead, that almoſt one half of the children born in Great Britain of great families die in their infancy. To many, indeed, this may appear a natural evil; but on due examination, it will be found to be one of our own creating. Were the deaths of infants a natural evil, other animals would be as liable to die young as man, but this we find is by no means the caſe.

A mother who abandons the fruit of her womb, as ſoon as it is born, to the ſole care of a hireling, hardly deſerves that tender appellation. Nothing can be ſo prepoſterous than a mother who thinks it below her to take care of her own child. If we ſearch nature throughout, we cannot find a parallel to this. Every other animal is the nurſe of its own offspring, and they thrive accordingly. Were the brutes to bring up their young by *proxy*, they would ſhare the ſame fate with thoſe of the human ſpecies [*].

> CONNUBIAL FAIR! whom no fond tranſport warms
> to lull your infant in maternal arms;
> who, bleſs'd in vain with tumid boſom, hear
> his tender wailing with unfeeling ear;
> the ſoothing kiſs and milky rill deny
> to the ſweet pouting lip, and gliſtening eye!—
> Ah! what avails the cradle's damaſk roof,
> the eider bolſter, and embroider'd woof!—
> Oft hears the gilded coach, unpity'd plains,
> and many a tear the taſſel'd cuſhion ſtains!
> No voice ſo ſweet attunes *his cares* to reſt,
> ſo ſoft no pillow, as his *mother*'s breaſt!—
>
> Dr. DARWIN.

A child, ſoon after the birth, ſhews an inclination to ſuck; and there is no reaſon why it ſhould not be gratified. It is true, the mother's milk does not always come immediately after the birth; but this is the way to bring it*: beſides, the *firſt milk* that the child can ſqueeze out of the breaſt anſwers the purpoſe of *cleanſing*, better than all the drugs in the apothecary's ſhop, and at the ſame time prevents inflammations of the breaſt, fevers, and other dangerous diſeaſes, from the ſuppreſſion of this natural ſecretion. It is ſtrange how people came to think that the firſt thing given to a child ſhould be *drugs*. This is beginning with medicine by times, and no wonder that they generally end with it. It ſometimes happens, indeed, that a child does not diſcharge the *meconium* ſo ſoon as might be wiſhed; this has induced phyſicians, in ſuch caſes, to give ſomething of an opening nature to cleanſe the firſt paſſages. Mid-

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[*] This general rule admits of but *few* exceptions.

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[*] Dr. ARMSTRONG, Phyſician to the Britiſh Lying-in Hoſpital, in this particular, ſeconds the advice given to mothers by the benevolent Dr. BUCHAN. An infant, ſays he, although for ſome time it has no great need for food; yet doubtleſs ought to be laid to the breaſt, as ſoon as the mother may, by ſleep, or otherwiſe, be ſufficiently refreſhed to undergo the little fatigue that an attempt to ſuckle may occaſion. This method, however unuſual with ſome, is moſt agreeable to nature. By means of putting the child *early* to the breaſt, eſpecially the firſt time of ſuckling, the nipple will be formed, and the milk gradually brought on. Hence much pain, and its conſequences, will be prevented, as well as the frequency of ſore nipples, which, in a firſt lying-in, have been wont to occaſion no ſmall inconvenience. To teach the child how to ſuck, a little milk and water, ſweetened with white ſugar, may be given it at the end of a tea-ſpoon, which the innocent will claſp in its mouth; or a finger wetted with it may be frequently put between its gums.

wives have improved upon this hint, and never fail to give ſyrups, oils, &c. &c. whether they be neceſſary or not. Cramming an infant with ſuch *indigeſtible ſtuff*, as ſoon as it is born, can hardly fail to make it ſick, and bring on a real occaſion for medicines.

Almoſt as ſoon as the babe is born the *officious nurſe*, knowing what is comfortable to herſelf, imagines that what is good for her, and her miſtreſs, cannot be bad for the poor infant. This naturally ſuggeſts the idea of cordials. Accordingly wine is univerſally mixed by nurſes with the firſt food of children, or DALBY's Carminative is adminiſtered. Nothing can be more fallacious, than this mode of reaſoning, or more hurtful than the conduct founded on it. Children need very little food for ſome time after their birth; and what they receive ſhould be light and of a cooling quality. A ſmall quantity of WINE hurries on the *reſpiration*, and conſequently the *circulation*, which nature for wiſe purpoſes has made already very *rapid* *.

If the mother or nurſe has enough of *milk*, the child will need no other food. Milk itſelf is produced from food taken in by the mother. It is in her ſtomach that the aliment is diſſolved, or digeſted, which by a combination of powers in the *chylopoiectic viſcera*, or parts preparing the chyle, is ſo far animalized * as to be converted into a kind of white blood. Hence it is very apparent, that previous to an infant having acquired ſtrength enough to convert ſolid food into bland and wholeſome chyle, and while the fibres of the ſtomach and inteſtines are peculiarly *irritable*, the parent, by a wiſe ſubſtitution in nature, has previouſly accompliſhed this work for the infant ſhe is about to nouriſh.

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* In a *new-born infant* the pulſe is about 134 in a minute, in *middle age* from 60 to 80, and in *extreme old age* from 50 to 24. Dr. ADAIR.

After the third or fourth month, it may then be proper to give the child, once or twice a day, a little of ſome other food †. This will eaſe the mother, will accuſtom the child by degrees to take food, and will render after weaning both leſs difficult and leſs dangerous. Nature abhors all ſudden tranſitions. For this purpoſe, the food of children ought not only to be ſimple, but to reſemble, as nearly as poſſible, the properties of milk. Indeed *milk* ſhould make a principal part of their food, not only before they are weaned, but for a long time after.

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* We may obſerve the hen hunting after *worms* and *little inſects* for its *young*; and poulterers follow without the bias of theory the ſame method of rearing them. REAUMUR gave two ducks, the one *animal*, and the other *vegetable* food, and having killed them, he found the animal ſubſtances *always* ſooner digeſted than the grain. Thus then it ſeems, that ANIMAL FOOD is much eaſier digeſted and tranſmuted in children into *animal ſubſtance*, by the powers of digeſtion, than the vegetable; and this plainly appears, if you begin from the firſt moment of the fœtus increaſing in the womb, where, till its coming into light, it is formed entirely of animal ſubſtance.

† As *ſoft biſcuit* or *cruſt of bread* (which are eaſier digeſted than *crumb*) with *milk* and *water*.

Bread may be given to a child as ſoon as it ſhews an inclination to chew. The very chewing of bread will promote the cutting of the teeth, and the diſcharge of ſaliva. Children diſcover an early inclination to chew whatever is put into their hands. Parents obſerve the *inclination*, but know not how to apply the *remedy*. Inſtead of giving to the child ſomething which may at once exerciſe its gums and afford it nouriſhment, they commonly put into its hands a piece of hard metal, or impenetrable coral. A cruſt of bread, or a piece of ſtick liquorice, is the beſt SUCK-THUMB. It not only anſwers the purpoſe better than any thing elſe, but has the additional properties of nouriſhing the child, and carrying the ſaliva down the ſtomach, which is a great promoter of digeſtion.

It is ſoon enough to allow children *animal food*, when they have got teeth to tear it. Then we ſhould remember

ber that their pulſe is uſually at 130, and from the obſervation of Mr. Townsend and others, the pulſe is quickened by *animal food*, and the ſame is not obſerved, when we have been eating only *vegetables* [*]. We ſhould therefore employ a due mixture of vegetable with their animal food, which, as the proper food of manhood, the formation of his *teeth* [†] naturally points out to the phyſiologiſts, and the experience of ages has proved to be the moſt conducive to health [‡]. As the ſtomachs of children cannot bear repletion, becauſe of their temperament, and as they require food not only to keep up the parts already formed, but alſo to make an addition to them, they ought therefore to have *ſlender*, but *frequent* meals, and this in proportion to their tender age.

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[*] Vide *the Guide to Health*, page 27.

[†] He has the *canine* or tearing teeth, the *inciſors* or clippers, and the *grinders*. Thoſe animals that have *only* the *canine teeth*, as the lion, &c. have a *gaſtric juice* that does not diſſolve *vegetables*; and on the reverſe, thoſe that have only the *inciſors* and *grinders*, as the horſe, &c. have a *gaſtric juice* that *only* diſſolves *vegetable ſubſtances*.

[‡] *Poverty*, ſays the celebrated ADAM SMITH, though it no doubt diſcourages, does not always prevent marriage. It ſeems even to be *favourable* to *generation* A half-ſtarved highland woman, frequently bears more than *twenty children*, while a pampered fine lady is incapable of bearing any, and is generally exhauſted by two or three. But *poverty*, though it quickens the powers of generation, is alſo extremely *unfavourable* to the *rearing* of children. *The tender plant is produced in ſo cold a ſoil, that it ſoon withers and dies. It is not uncommon in the highlands of Scotland, for a mother who has borne* TWENTY *children to have but* TWO *alive.*

2. OF THE FOOD PROPER FOR MANHOOD.

It is an ancient and approved maxim, that a life guided entirely according to the directions of art, muſt be a miſerable one, and the moſt judicious practitioners, ſenſible of the juſtneſs of the obſervation, and that what is prohibited is often the more eagerly coveted, have endeavoured, even to perſons labouring under diſeaſe, to give as great latitude as poſſible in the articles of diet, and to reconcile every part of the regimen they preſcribe, as nearly as they can, to the common mode of living, in order that the patient may be reminded as little as poſſible of his misfortune *. Our directions therefore ſhall not be frivolouſly minute, but as ſhort as poſſible on this ſubject.

In the firſt place we ought carefully to *chew* our food, otherwiſe we ſhall impoſe much unneceſſary labour on the ſtomach, and retard digeſtion.

With reſpect to *quantity*, it is evident that this muſt be regulated by our feelings. A healthy man cannot be ſaid to exceed in the quantity of his meal, if he finiſhes it with a reliſh for more; if, immediately after eating, he can, if required, follow any employment, that does not demand ſtrong exerciſe or violent exertions; which to perſons in eaſy circumſtances will rarely be neceſſary, and ought in general to be avoided, as it diſturbs digeſtion *; though daily practiſed from neceſſity, by the labouring poor †.

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* Vide page 223.

Gluttony is ſo ungentlemanly a vice, that it would be an affront to ſuppoſe that perſons of poliſhed manners, who are the perſons who will probably read this book, could be capable of it. I ſhall therefore forbear to mention the innumerable train of evils that in time is certain to attend this beaſtly practice.

With reſpect to the *proper times* for eating, firſt,

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* Dr. ADAIR.

† This has been before *ſeriouſly* adverted to in page 207, and it is hoped will finally have its *due weight,* the conduct of maſters being here (like the traffic in human fleſh) both *cruel* and *impolitic*. Dr. HARWOOD, the Profeſſor of Anatomy at *Cambridge,* took two pointers equally hungry, and equally well fed; the *one* he ſuffered to lie *quiet* after his meal, the *other* he kept for above two hours in *conſtant exerciſe*. On returning home he had them both killed. *In the ſtomach of the dog that was quiet and aſleep, all the food was digeſted*; *but in the ſtomach of the other dog that proceſs was ſcarcely begun.*

OF BREAKFAST.

As our anceſtors breakfaſted early, they dined alſo early, and had at leaſt two meals after this, as appears from the allowance appointed for a *Lady Lucy*, who ſeems to have been one of the maids of honour in the court of HENRY the VIIIth. I may be allowed to mention their articles of food, as a matter of curioſity, to ſhew in what manner the *fine ladies* lived in thoſe days.

This lady was allowed for BREAKFAST,

- *a chine of beef*,
- *a loaf*, and
- *a gallon of ale*.

We have an account alſo of the BREAKFAST of an *earl* and *counteſs* in the lent ſeaſon, viz.

- *a loaf of bread*,
- 2 *manchettes* (which ſeems to have been loaves of a coarſer bread),
- *a quart of beer*,
- *a quart of wine*,
- 2 *pieces of ſalt fiſh*,
- 6 *baconed herrings*,
- 4 *white herrings*, and
- *a diſh of ſprats*.

With reſpect to the *quality* of our different meals, we ſeem to depart more from the cuſtom of our hardy anceſtors with regard to *breakfaſt*, than any other meal. The contraſt at firſt ſight appears truly ridiculous. *A maid of honour*, in the court of Queen ELIZABETH, breakfaſted upon *beef*, and drank *ale* after it; whilſt the *ſportſman*, and even the *day-labourer*, now breakfaſt upon *tea*.

The philoſopher here humbly attempts to vindicate the preſent race; he believes that *ſleep*, which hereafter will be fully conſidered *, *accumulates* the irritability of the fibre, diſpoſing it to be more readily affected by ſtimuli of all kinds, hence the violent effects of all cordials taken in the morning, and hence perhaps the propriety of the gently ſtimulating power of coffee or bohea tea †. He would alſo recommend here *bread* moulded into ſuch ſhapes as to produce a great deal of *cruſt* ‡, and he would recal the reader, who reckons health as the firſt bleſſing, and as the means of enjoying and heightening all other bleſſings to reflect on the utility of the *ſaliva*, and to remember that bread when buttered abſorbs little or no ſaliva, while a pound of dry bread carries down with it the ſame weight of this neceſſary moiſture*. We would here, therefore, only caution the reader againſt taking his tea *too hot*, and if he has been engaged throughout the preceding day, or that morning, in much exerciſe, to join with this neceſſary meal one or two ſoft *boiled eggs* †.

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* Vide Law III. *on the Accumulation of Excitability.*

† TEA, whether *green* or *bohea*, is the produce of the *ſame* plant, the *green tea* being the ſhoots and earlier leaves, and *bohea* thoſe more *advanced* and *expanded.* Like other ſtimuli *green tea* made very ſtrong is an *emetic*, or occaſions *tremors*; if moderately ſtrong it *agreeably refreſhes* after a fatiguing journey, and from its excitement is productive of *wakefulneſs* to habits unaccuſtomed to *that ſtimulus.* GREEN TEA is ſuited *only* to *old age*, and *cold unirritable habits.*

‡ We ſaw before that *ſolid ſubſtances* are eaſier acted upon than *glutinous.* Thus

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Thus *hot water* ſooner diſſolves *white ſugar* than *ſoft gum*, and *aqua fortis* corrodes copper, though it does not touch *wax*. It is leſs ſubject to *aceſcency*, and does not *ſwell* in the ſtomach.

* Pieces of meat, that may happen to get between the teeth, are *diſſolved* by this menſtruum, or at any rate are ſo *ſoftened*, and *their texture broken*, that this inconvenience is ſpeedily removed. If not a fluid, poſſeſſing properties the ſame as the *gaſtric fluid*, it muſt be allowed, certainly, that it *greatly aids that ſolvent*. Vide page 222. If this penance be too great for the middle period of life, and muffins and crumplets ſoaking in butter muſt be indulged in, *children*, however, may be prohibited *butter*, and be made to have *good conſtitutions*, by which the contagion of *bad example* will afterwards be leſs ſeverely felt.

† This cuſtom univerſally prevails in IRELAND, and is better than *hung-beef* and *anchovies*, which accompany the SCOTCH breakfaſt.

OF DINNER.

The *ſame lady* who had *ſo ſolid a breakfaſt*, had for DINNER,

a piece of boiled beef,
a ſlice of roaſted meat, and
a gallon of ale.

IN THE AFTERNOON,

a manchette, and
half a gallon of ale.

FOR SUPPER,

a meſs of porridge,
a piece of mutton,
a cheat (or finer loaf),
and a gallon of ale.

To be ſociable after ſupper, there was left on table,

a manchette loaf,
a gallon of ale, and
half a gallon of wine.

This lady had therefore four HEAVY *meals.* Inſtead of this we are led to recommend the modern practice of late dinners.—But becauſe long faſting is injurious, and when very hungry we may be induced to eat more at this principal meal than can be properly digeſted, we would recommend *cold meats* or *ſoups* by way of COLLATION.

For dinner we would adviſe to thoſe, who have a due ſenſe of the importance of health, to keep as much as poſſible to *one diſh*. To prefer MUTTON [*] to lamb, *lamb* to *chicken* or *veal*, and BEEF, if tender, to either of the *three* laſt, and as *fiſh* is ſoon digeſted, to unite ſome fleſh meat with it, and to add to theſe *vegetables*. Could I believe I ſhould be liſtened to with indulgence, and not incur the general cenſure of prejudice, having nothing but *philanthropy* and *the improvement of ſcience* for my object, I would condemn, for convaleſcent and weak perſons, thoſe heterogeneous combinations called *puddings* [†], and am inclined to condemn alſo, though not the fruit, yet the *cruſt* of *all pies*. Let my readers here call to mind, that eggs and milk are both reckoned wholeſome *ſeparate*, but when combined, form a compound ſuited only for *ſtrong ſtomachs* [‡].

OF

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[*] When SANCTORIUS eat MUTTON, which was a food peculiarly grateful to his ſtomach, his *feelings* were *pleaſant*, and his *perſpiration copious*;—when he eat PORK, GOOSE, DUCK, MUSHROOMS, or MELONS, he was *heavy* and *oppreſſed*; and found, by the balance, that *his perſpiration* was *diminiſhed* one half. This proves that even the *perſpiratory diſcharge* is very much under the influence of the STOMACH.

[†] Very few exceptions to this rule. The plaineſt puddings are generally very *compound*.

[‡] THE ART OF COOKERY I am apt to liken to the diabolical art of *undermining a town*. We all avoid the *red poiſon berries*, and caution others againſt

OF DRINKING AFTER MEALS.

A foreigner was invited to a party conſiſting, as he was told, of *Engliſh philoſophers*, of whom he conceived a great deal. After a very plenteous dinner the cloth was cleared, and the bottles were placed on the table.

them, though we give our FRIENDS *poiſoned pickles, and preſerves made in copper ſaucepans*, &c. and hold out ſuch temptations to ***over-gorging***, which weak minds cannot reſiſt.

> ————————————They dine
> with diſhes tortur'd from their native taſte,
> and mad variety, to ſpur beyond
> its wiſer will the jaded appetite!
> *Is this for pleaſure?*—Learn a juſter taſte;
> and know, that TEMPERANCE is TRUE LUXURY.
> *Or is it pride?*—Purſue ſome nobler aim.
> Diſmiſs your paraſites, who praiſe for hire;
> and earn the fair eſteem of honeſt men,
> whoſe praiſe is fame. Formed of ſuch clay as yours,
> the ſick, the needy, ſhiver at your gates.
> Even modeſt want may bleſs your hand unſeen,
> though huſh'd in patient wretchedneſs at home.
> Is there no virgin, graced with every charm
> but that which binds the mercenary vow?
> No youth of genius, whoſe neglected worth
> unfoſter'd ſickens in the barren ſhade?
> No worthy man, by fortune's random blows,
> or by a heart too generous and humane,
> conſtrain'd to leave his happy natal ſeat?
> *There are, while human miſeries abound,*
> *a thouſand ways to waſte ſuperfluous wealth.*
>
> ARMSTRONG.

He was preſſed after five glaſſes to drink on; but the ſtranger perſiſted in aſſuring the company " *he felt no drought.*" Theſe *philoſophers* began then to be *angry*, and the foreigner rang the bell, and *inſiſted* on another courſe, for *they* ought, as much to *eat* againſt reaſon and inclination, as *he* to *drink*.

I would here recommend the excellent ſaying, *a glaſs* for *digeſtion*, *another* for *my relations*, a *third* for *my king*, a *fourth* for *my country*, and a *fifth* for *my enemy*.

It will not, I think, admit of a doubt, that *beer* or *water* is the only drink neceſſary in *early youth*; and that *wine*, and *ſpirituous liquors*, of which luxury has introduced a variety, ought to be appropriated ſolely to the *middle period*, to the comfort of *invalids* *, and the invigoration of *old age*.

To

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* The great objection, however, againſt *geneva* and *water*, and *brandy* and *water*, is, that *invalids* are very apt to increaſe the proportion of the ſpirit ordered, and the great Dr. FOTHERGILL, who was among the firſt who gave ſanction to this practice, declared, ſome time before his death, that he repented of having done ſo, from the *unfortunate habit* that had *ſtole* on ſome of his patients.

> On pleaſure's flowery brink we idly ſtray,
> maſters *as yet* of our returning way.
> Seeing no danger—we diſarm our mind,
> and give our conduct to the waves and wind.

Then

To the credit of the preſent age, *hard drinking* is rarely practiſed by perſons of liberal education; though, from the habit of ſitting at table ſome hours after dinner, we are tempted to *exceed* in the quantity of wine; which even with perſons in health too frequently deſtroys in time the tone of the ſtomach.

Were the pleaſure of the palate laſting, ſays CORNARO, *there would be ſome excuſe for inebriety, but it is ſo tranſitory, that there is ſcarce any diſtinguiſhing between the beginning and the ending*; *whereas the diſeaſes it produces are very durable*. This fact is well known in the diſtilleries,

Then in the flowery mead, or verdant ſhade,
to wanton dalliance negligently laid,
we weave the chaplet, and we crown the bowl,
and ſmiling ſee the *nearer waters* roll,
till *the ſtrong guſt* of *raging paſſions* riſe,
till the dire tempeſt mingles earth and ſkies,
and ſwift into the boundleſs ocean borne,
our *fooliſh confidence* too late we mourn;
round our devoted heads the billows beat,
and from our troubled view the leſſening lands retreat.

PRIOR.

Spirits, ſays the Abbe RAYNAL, were the gift the moſt fatal the old world ever made to the new. It was ſoon obſerved, that it diſturbed their domeſtic peace, deprived them of their judgment, and made them furious. In vain did ſome Frenchmen expoſtulate with them, and endeavour to make them aſhamed of *theſe exceſſes.* "*It is you,*" anſwered they, "*who have*
"*taught us to drink this liquor, and we cannot do without it. You have done the*
"*miſchief, and it admits of no remedy.*"

where the SWINE which are fattened by the ſpirituous ſediments of barrels, all acquire *diſeaſed livers.*

Mark what happens to that man who drinks a quart of wine or of ale, if he has not been habituated to ſo violent and exhauſting a ſtimulus. He loſes the uſe both of his limbs and of his underſtanding! He becomes a temporary idiot, and has a temporary ſtroke of the palſy! And though he ſlowly recovers after ſome hours, is it not reaſonable to conclude, that a frequent repetition of ſo powerful a poiſon muſt at length permanently affect him?—If a perſon accidentally becomes intoxicated by eating a few muſhrooms of a peculiar kind, a general alarm is excited, and he is ſaid to be poiſoned; but ſo familiarized are we to the intoxication from vinous ſpirits, that it occaſions merriment rather than alarm.

The ſtory of *Prometheus* ſeems to have been invented by phyſicians in thoſe ancient times, when all things were clothed in hieroglyphic, or in fable. *Prometheus* was painted as ſtealing *fire* from heaven, which might well repreſent the inflammable ſpirit produced by fermentation; which may be ſaid to animate or enliven the *man of clay*: whence the conqueſt of *Bacchus*, and heedleſs mirth and noiſe of his devotees.—*But the after puniſhment of thoſe, who ſteal this accurſed fire, is a vul-*

ture gnawing the liver; *and well allegorizes the poor inebriate lingering for years under painful hepatic diſeaſes* *.

Drinking is undoubtedly the moſt miſerable refuge from misfortune. It is the moſt broken of all reeds. This ſolace is truly ſhort lived; when over, the ſpirits commonly ſink as much *below* their uſual tone, as they had before been raiſed *above* it. Hence a repetition of the doſe becomes neceſſary, and every freſh doſe makes way for another, till the miſerable wretch is rendered a ſlave to the bottle; and at length falls a ſacrifice to what at firſt, perhaps, was taken only as a medicine. No man is ſo dejected as the drunkard when the debauch is over. Hence it is, that thoſe who have the greateſt flow of ſpirits while the glaſs circulates freely, are of all others the moſt hipped when ſober. It may be pleaſant to get drunk, but the next day is a day of uneaſineſs, and the third ought to be a day of repentance. To thoſe who drink to drive away care, I would recommend the careful peruſal of the following lines.

> Unhappy man, whom *ſorrow* thus and *rage*,
> two different ills, alternately engage.
> Who drinks, alas! *but to forget*,—nor ſees
> that melancholy, ſloth, ſevere diſeaſe,

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* Dr. Darwin.

memory confuſed, and interrupted thought,
DEATH'S HARBINGERS, lie LATENT in the draught,
AND IN THE FLOWERS THAT WREATH THE SPARKLING BOWL
FELL ADDERS HISS, AND POISONOUS SERPENTS ROLL.

PRIOR.

OF SUPPER.

A *late dinner* gives a long morning, and precludes the neceſſity of a hearty ſupper, and tea may become its ſubſtitute, and call together, to a cheap entertainment and the pleaſures of ſocial intercourſe, a meeting of cheerful friends. Abſtracted from the cares of the buſy day, having no variety of objects to draw off the attention, viewing the expreſſive and brilliant countenance of thoſe he is in converſe with, with ſpirits gently agitated, and cares diſpelled, he returns with the partner of his choice, from the ſplendid circle, and wakes the next morning refreſhed by a ſound and tranquil ſleep.

3. OF OLD AGE.

The *food* proper for *old age* has been before conſidered, when diſcourſing on *temperaments*.

SECT. XI.

ON VITAL, OR OXYGEN, AIR ENTERING INTO THE COMPOSITION OF OUR BODY.

A **LAD**, at Newmarket, having been almoſt ſtarved, in order that he might be reduced to a proper weight for riding a match, was weighed at 9 o'clock in the morning, and again at 10 o'clock, and he was found to have gained near 30 *ounces* in the courſe of an hour, though he had only drank *half a glaſs* of wine in the interval[*]. A gentleman in the city was lately weighed before dinner, and was highly offended to find from his weight, not long after dinner, that he muſt have eat, unleſs ſome deceit was played on him, above *two pounds* of beefſteaks.

The reader will here call to mind the Section "*On the Balance betwixt Reſpiration and Digeſtion*[†]," and will diſcover, perhaps, the ſolution in part of this difficulty from ſrom the increaſed attraction of the blood for the *vital*, or *oxygen*, *portion* of the *air*: for, from careful and repeated experiments, it appears, that the abſorbents of the ſkin do not act, unleſs when violently irritated, the cutis ſerving as a covering to the mouths of theſe veſſels*.

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[*] From Dr. WATSON's Chemical Eſſays.

[†] The quantity of air conſumed in a minute by us is *a gallon:* under certain circumſtances it is *more*, according to the *quantity* and *nature* of the food. The

It is impoſſible, ſays the author of the *Medical Spectator*, indeed, to peruſe the following extract from a late publication of Dr. BEDDOES without feeling the warmeſt approbation, and the moſt anxious deſire to co-operate with him and Drs. DARWIN, EWART, THORNTON, and thoſe other phyſicians whoſe letters he has publiſhed, in their laudable attempts to render the PNEUMATIC CHEMISTRY *uſeful to mankind*.—Theſe, I am well per-

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The quantity of air then conſumed in an hour, and the weight of the *oxygen portion* being deducted, and added to the weight of the food taken into the ſtomach, would give ſome ground for conjecturing the weight of air acquired in a day.

* The hands and arms of ſeveral perſons were plunged into water in which *muriated mercury* was diſſolved, and no effects were produced where the ſkin was entire: but the ſame quantity of water and mercury remained. Again, *ſcammony* was applied to the body by means of a plaſter: but it produced no viſible effect. However, when an *irritation* was made, and the rampart of the ſkin was deſtroyed, it operated, as though it had paſſed into the bowels by means of the ſtomach. No water was abſorbed either in the cold or hot bath. See the Memoir of Monſ. SEGUIN, in *La Medecine Eclairée par les Sciences Phyſiques.*

ſuaded, muſt be the ſentiments of *every medical man, who poſſeſſes a ray of true ſcience*; and *to me*, it is particularly pleaſing, becauſe I alſo have many years ago entertained an opinion nearly ſimilar. "A firm per-"ſuaſion," ſays Dr. BEDDOES, "had long ſettled on "my mind, *that the ſyſtem might be as powerfully and as "variouſly affected by means of the lungs as of the ſtomach. "And the more knowledge we have acquired of the proper-"ties of elaſtic fluids, the more has this my opinion been con-"firmed. Of all the functions,* RESPIRATION *is, I think, "the beſt underſtood; and it will alſo be found in philoſo-"phic and cautious hands to be the moſt eaſily managed. It "is impoſſible,* adds Dr. BEDDOES, *now to doubt, that "we are* NOURISHED BY THE LUNGS, AS TRULY, AS "BY THE STOMACH; *and that what we take in at the "former entrance becomes, like our food, a part of the ſub-"ſtance of our ſolids as well as our fluids.—By the lungs "we can alſo introduce* EFFECTUAL ALTERATIVES *of "the blood, and by conſequence act on all the parts nouriſh-"ed by the blood. For ſome time,*" adds this illuſtrious philoſopher, "*I breathed* OXYGEN AIR, *with a certain "portion of atmoſpheric air, and* I FELT AT THE TIME "OF INSPIRATION THAT AGREEABLE GLOW AND "LIGHTNESS OF THE CHEST, WHICH HAS BEEN

“ DESCRIBED BY DR. PRIESTLEY AND OTHERS, IN A VERY SHORT TIME I PERCEIVED A GENIAL WARMTH, AND A GREATER FLOW OF SPIRITS THAN USUAL, AND BY DEGREES MY COMPLEXION FROM AN UNIFORM BROWN BECAME FAIRER AND SOMEWHAT FLORID. I PERCEIVED ALSO A CARNATION TINT AT THE END OF MY FINGERS, AND MY LIPS BECAME OF A BRIGHT RED.”

“ *I even think it probable, that* OXYGEN, *or* VITAL AIR, *which, by uniting with the blood, creates ſuch a beautiful colour to the complexion, may ſuperſede all other coſmetics; one deciſive advantage it will certainly have over them all, for while it improves the looks, it will, if rightly adminiſtered, amend the health alſo* *.” The latter part of this experiment points out the analogy there is betwixt *exerciſe* † and *our inhaling a ſuper-oxygenated atmoſphere*; and places, in the ſtrongeſt point of view, that *oxygen*, or *vital*, *air*, by blending with the *blood*, becomes one of the CONSTITUENT PRINCIPLES of our body.

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[*] From Dr. BEDDOES's Letter to Dr. DARWIN, on the New Method of curing Pulmonary Diſorders.

[†] Vide the Section on *Exerciſe*, and the Experiment which proves that vital air is abſorbed by the blood, page 70.

ON CLOTHING.

SECT. XII.

1. *Of the Clothing of Infants.*

MIDWIFERY was firſt practiſed by women. Hence the dreſſing of children became an art which few could attain unto. Each midwife ſtrove to outdo all others in this pretended knowledge. Theſe attempts were ſeconded by the vanity of parents, who, too often deſirous of making a ſhow of the infant as ſoon as it was born, were ambitious to have as much *finery* heaped upon it as poſſible. Thus it came to be thought as neceſſary for a midwife to excel in bracing and dreſſing an infant, as for a ſurgeon to be expert in applying bandages to a broken limb; and the poor child, as ſoon as it came into the world, had as many rollers and wrappers applied to the throat * and body, as if every bone had been fractured in the birth; while theſe were often ſo tight, as not only to gall and wound its tender frame, but even to obſtruct the motion of the organs neceſſary for life.

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* As the *long ſtay* to hinder the child from bending back the head and breaking its neck!

NATURE knows no other uſe of clothes but to keep the body *warm*. All that is neceſſary for this purpoſe, is, when the child is born, to excite the external circulation by rubbing it with brandy and water with the warm hand, and having affixed the *belly-band* made of *fleecy hoſiery* *, to wrap it in a looſe covering of the ſame ſoft material; and then to lay it by the ſide of the fond mother to partake of *her* vital warmth †. Were parents left to the dictates of nature alone, they would certainly follow this method. If we conſider the body of an infant as a bundle of ſoft pipes, repleniſhed with fluids in continual motion, the danger of *preſſure* ‡ will appear in the ſtrongeſt light. NATURE, in order to make way for the growth of children, has formed their bodies ſoft and flexible; and leſt they ſhould receive any injury from preſſure in the womb, has ſurrounded the fœtus every where with yielding fluids. This ſhews the care

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* More will be ſaid hereaſter of this happy diſcovery. At the ſame time that it is *warm* and *unirritating*, it is perfectly *elaſtic*.

† Vide Section VII. Part II. *How life depends on a certain degree of heat in the body*.

‡ Some allowance ought likewiſe to be made for the ſwelling of the muſcles during ſleep.

which NATURE takes to prevent all unequal preſſure on the bodies of infants, and to defend them againſt every thing that might in the leaſt cramp or confine their motions.

Not only the analogy of other animals, but the very feelings of infants, inform us, they ought to be kept eaſy and free from preſſure. They cannot indeed tell us their complaint; but they can ſhew ſigns of pain; and this they never fail to do, by crying when pinched by their clothes. No ſooner are they freed from their bracings, than they ſeem pleaſed and happy; yet, ſtrange infatuation! the moment they hold their peace, they are again committed to their chains. I have known, ſays the benevolent Dr. BUCHAN, numerous children ſeized with *convulſion-fits* ſoon after the midwife had done ſwaddling them, who, upon taking off the rollers and bandages, were immediately relieved, and never had that diſeaſe afterwards.

SECT. XIII.

2. *Of the Clothing of Adults.*

WE have before ſeen the benevolent care of PROVIDENCE to the lower order of creatures in providing them with CLOTHING *ſuited to the climate and the ſeaſon of the year*[*]. The horſe, the deer, and birds, *double* their covering in the beginning of the cold ſeaſon, and *ſhed* it in the ſpring when a warm garment is no longer ſerviceable.—The beaver removed to the higher latitudes exchanges its fur, and the ſheep its wool, for a coarſe hair, *to allow of the eſcape of heat*. The coarſe and black ſhag of the bear, on the contrary, is converted in the arctic regions into the fineſt and whiteſt fur *to retain the vital flame*.—In ſhort, the ſoftneſs and denſity of hair in animals ſeems always in proportion to the coldneſs of the country. The Canadian and Ruſſian furs are therefore better than the furs of climates farther removed from the north. It is well known that the fur of the ermine is the moſt valuable of any hitherto diſcovered: and it is in winter only that this little animal has it of the proper colour and conſiſtence. NATURE has provided ſome animals with another reſource; when the ſeaſon becomes too cold for their conſtitutions, they ſleep † or emigrate into warmer climates.

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[*] Vide what was ſaid Sect. II. Part II. *On Animal Heat*; alſo Sect. III. *How Life depends on a certain Degree of Heat in the Body*; and Sect. IV. *On the Method Nature takes to increaſe or rid herſelf of this ſubtle and penetrating Fluid.*

Pliny, one of the moſt celebrated naturaliſts of antiquity, pathetically laments, "that whilſt NATURE has "given various clothing to the brute creation, and even "fenced plants and trees with bark, againſt the injuries "of the cold and heat, ſhe would have caſt man into "this world naked and unprovided againſt the inclemency of different climates and ſeaſons." But inſtead of agreeing with that philoſopher, that NATURE has, in this particular, acted more like a cruel ſtepmother, than a kind and indulgent parent to man, we cannot ſufficiently extol her providence and wiſdom. It was no more than conſiſtent with equity to provide the irrational part of her works with clothing ſuitable to their circumſtances; but man, whom ſhe endued with the tranſcending faculty of *reaſon*, ſhe hath very wiſely left to accommodate himſelf to the difference of ſeaſons and of climate, and to clothe himſelf accordingly with the plumes, the fleeces, the ſkins of animals, and the products of various plants and trees. This would invariably be found to be the caſe, were not man, alas! ſervilely imitative, and in the higheſt degree capricious in the ornaments of his perſon! Hence it is, that the nations beyond the *Indus*, as well as the *Tartars*, are at great pains to compreſs their eyes at the corners, and to ſtretch their ears by heavy weights appended to them, and pulling them frequently with the fingers, ſo that they may hang down to their ſhoulders, which *they* conſider as the higheſt beauty. On the ſame principle, they extirpate the hair from their bodies; and, on the face, they leave only a few tufts here and there. The *Tartars* frequently extirpate the whole hair of the head, except a knot on the crown, which they braid and adorn in different manners. Some, and among others the *Turks*, cut the hair off their heads, and let their beards grow. The *Europeans*, on the contrary, ſhave their beards, and wear their hair. Every nation ſeems to have entertained different prejudices, at different times, in favour of one part or another of the beard. Kingſon aſſures us, that a conſiderable part of the religion of the *Tartars* conſiſts in the management of their whiſkers; and that they waged a long and bloody war with the

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† Vide note *, page 95.

Perſians, declaring them infidels, merely becauſe they would not give their whiſkers the *orthodox* cut. PETER the Great had nearly occaſioned a revolution in his kingdom, by wiſhing to have his ſubjects ſhaved. In our country we daily ſee men, who encourage the growth of the hair on the cheek, below the ear, to look fierce, while others again wiſh to have the ſize of their underſtanding meaſured by the ſize of their heads. The largeneſs of the doctor's wig * ariſes evidently from the ſame cauſe as the ſmallneſs of the beau's queue. In *Arabia* and *Greece* large eyes are eſteemed beautiful; and in theſe countries they take extraordinary pains to ſtretch the lids, and extend their aperture. Among ſome *Indian tribes* in *America* they flatten the forehead in infancy by the application of broad plates of lead, and file to a point all the teeth to imitate the canine. In *Africa* they flatten the noſe, to accompliſh *their* idea of beauty. The ſkin in many nations is darkened by art; and all ſavages eſteem certain kinds of deformity to be perfections; and ſtrive to heighten the admiration of their perſons, by augmenting the terror of their features. In *China*, the reigning faſhion is ſtill more contemptible, to appear *ever idle*, they ſuffer their finger nails to grow to an enormous length, and *pinch their feet* into the ſmalleſt ſize imaginable. The latter cuſtom has unfortunately reached theſe kingdoms. Inſtead of having the ſize and figure of the ſhoe adapted to the ſhape of the foot, the toes muſt be crampt, and deprived of all ſeparation, which the perſpiration of that part ſeems to demand *, and nine tenths of mankind are troubled with corns, a complaint that is ſeldom or never occaſioned but by narrow and pointed ſhoes. The ladies, who ever improve on the faſhions of the time, to gain a little in height, lengthen out the heel, and conſtantly walk on *tiptoe*. The conſequence of which is, acting contrary to the intentions of NATURE, they never ſeem to walk well, and as the fibres of the muſcles of the calf are not drawn into their due tenſion, they become ſubject to frequent and incurable *cramps*, which, as diſturbing ſleep, is again the remote cauſe of other dreadful diſorders.

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* The tye-wig was diſuſed in England through the humour of Dr. SOMERVILLE. Some of the faculty having taken offence, that he came not unfrequently to *George*'s unarrayed with the ſword, and in coloured clothes, and being on that account one day openly inſulted by his indignant brethren, he came the next day to the coffee-houſe, having on the jehu of his coachman, who, on the contrary, had on the doctor's tye. "*Here, gentlemen,*" he ſaid, "*is an argument to the purpoſe, that knowledge does not conſiſt in exteriors. There* "*are none of you, who would truſt me to drive you, and the world ſhall ſoon* "*ſee, alſo, as I paſs through the ſtreets of London,* THAT THE WIG DOES "NOT CONSTITUTE THE PHYSICIAN." Having made for ſeveral days this curious exhibition, the tye-wig was quickly converted into a ſubject of ridicule.

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* Dr. VAUGHAN, of Rocheſter, recommends ſtockings to be made with the ſeparation like gloves.

The ſhape God has given is too often attempted to be *mended* by dreſs, and thoſe who know no better, believe that mankind would be frights without its aſſiſtance. The bones of growing perſons are ſo cartilaginous, that they readily yield to the ſlighteſt preſſure, and eaſily aſſume the ſhape of the mould in which they are confined. Hence it is that ſo many girls in proportion to boys are misſhapen *. Deformity of body may indeed proceed from weakneſs or diſeaſe; but in general, ſays Dr. Buchan, it is the effect of improper clothing. The preſſure of the abdomen by ſtays impedes the action of the ſtomach and bowels, and the motion neceſſary for reſpiration, and conſequently the juſt circulation of the blood. Hence a train of dreadful diſorders enſue. The pliancy of the body, and the natural grace of the ſemale form, is prevented by this rigid coat of mail. The imprudent zeal of the mother for a fine ſhape performs another moſt unkindly office to the child. She frequently becomes either incapacitated for marriage, or dies in child-birth. The madneſs in favour of ſtays ſeems, however, to be ſomewhat abated; and it is hoped the world will, in time, become wiſe enough to know, that the human ſhape does not ſolely depend upon whale-bone and bend-leather.

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* A lady in the city, who had had no girls, though her family was numerous, but were *misſhapen*, conſulted the celebrated anatomiſt Mr. Cline, on the prevention. "*To have no ſtays—and to let the next girl run about like the boys*," was the excellent advice of this gentleman, which being complied with, neither ſhe or any of the future children were afterwards *marred* by the ill-placed attention of the ignorant mother. This ſtory Mr. Cline is very careful to deliver in his public lectures at St. Thomas's Hoſpital twice a year.

In *England* we ſeldom enjoy any continuance of ſettled weather, except towards the cloſe of ſummer, and the beginning of autumn, and even then we are frequently balked in our expectations. The ſudden changes that take place during three fourths of our year may be regarded as no leſs prejudicial to the health, than diſagreeable to our feelings; and our terrors of *catching cold*, which have frequently appeared ridiculous to foreigners, are really better founded than we ourſelves are apt, moſt of us, to apprehend; *colds* in their conſequences proving fatal to thouſands every year. Though we cannot hope entirely to eſcape the unpleaſant ſenſations, or altogether to ward off the fatal effects occaſioned by this caprice of our climate; yet conſidering properly *the nature of clothing*, we may avoid much of the danger. If *ladies* are ſubject to *catch cold* more frequently than men, it is not *alone* their delicacy of conſtitution, or their being more confined within doors; but the frequent changes they make in the quality or quantity of their garments, and ſometimes, however fearful of a partial current of air, becauſe they expoſe even thoſe parts of the body, that a little before had been warmly covered. If a greater proportion of females fall victims to *conſumption*, is it not becauſe, loſing ſight more than men of its primary purpoſe, ſays Dr. BEDDOES, they regulate their dreſs ſolely by fantaſtic ideas of elegance? If happily our regret ſhould recal the age of chivalry,—to break the ſpell of faſhion would be an achievement worthy the moſt gallant of our future knights. Common ſenſe has always failed in the adventure; and our ladies, alas! are ſtill compelled, whenever the enchantreſs waves her wand, to expoſe themſelves, half undreſſed, to the fogs and froſts of our iſland.

It is, I believe, adds the celebrated Dr. BEDDOES, unfortunate for the inhabitants of this country, that we are not ſubject to ſuch a continued ſeverity of cold, as ſhould oblige us regularly to fortify ourſelves by warm clothing. By linen, worn excluſively, we loſe more in health than we gain in comfort; which comfort is, perhaps, after all, is merely imaginary; for from the repreſentation of Dr. THORNTON, he appears to have ſupported the remarkable heats of a very hot ſummer, better than moſt other perſons, by having on, inſtead of linen next his ſkin, a *fleecy hoſiery waiſtcoat*[*].

It is a miſtaken notion, ſays Sir BENJAMIN THOMSON, that flannel is too warm a clothing for ſummer. I have worn it, ſays he, in the hotteſt climates, and in all ſeaſons of the year, and never found the leaſt inconvenience from it. Sir BENJAMIN moreover adds, I ſhall be happy if what I have ſaid or done reſpecting *flannel*[†] ſhould induce others to make a trial of what I have ſo long experienced with the greateſt advantage, and which I am confident they will find to contribute greatly to health, and conſequently to all the other comforts and enjoyments of life. As being the moſt effectual method to eſcape the influence of ſudden changes of atmoſpherical temperature, and becauſe flannel is ſo much leſs unpleaſant, when moiſt, than linen. *Fleecy hoſiery* or *flannel* ſhould be worn during every ſeaſon in Great Britain; and thoſe who feel it neceſſary may add above the linen in winter a cotton under waiſtcoat, which he may put off during the warm weather, and reſume again in the autumn. The philanthropic JONAS HANWAY was a very great advocate for *warm clothing*. Being in a decline, he was ordered by his phyſicians to the ſouth of France: but ſome very urgent buſineſs calling him to viſit Holland, in the moiſt air of that country he ſpeedily recovered, and remarks that the Dutch are free from this dreadful calamity, which he attributes partly to the air *, and partly to their warm method of clothing. He adds, if a number of perſons meet in a room, where there is no fire, and they feel cold, no pleaſant converſation takes place, and *warm clothing* ought therefore to be uſed, if for no other reaſon than for the preſervation of *good humour*. BOERHAAVE's favourite receipt for health was, "to leave off our winter clothing on Midſummer day, and to reſume it the day following."

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[*] Vide his Letters as publiſhed by Dr. BEDDOES, in which he adds, "*and* "*ſince my firſt uſing this under garb, I am not ſubject to catch cold as formerly* "*from the viciſſitudes of the weather.*"

[†] Had Sir BENJAMIN THOMSON known the *fleecy hoſiery*, he would moſt probably have recommended it in preference to *flannel*. It *equally* attracts and imbibes the moiſture of the ſkin: but the former as being *elaſtic* embraces the body, as being from an animal ſubſtance is *warmer* and *lighter* for wear than flannel, and as being of a *ſofter texture* does not unpleaſantly and injuriouſly *irritate* the ſkin.

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* Thoſe conſumptive patients, whom *we* hurry off to the clear air in the ſouth of France, the *French phyſicians*, on the contrary, order to the foggy air of Lyons. As they cannot *both* be right, and as the HOT WELLS favours the ſentiments of the latter, being near a great town, where innumerable works are carrying on, and ſituated on the borders of marſhy ground, and a river the moſt choaked up with mud of any in the world, there is ſome probable grounds for doubting of the juſtneſs of *our* prevailing practice. Vide the Section on *Phthiſis Pulmonalis*.

To keep an animal in health, beſide the retaining of a due degree of animal heat*, there muſt be a continued generation of new juices, and a perpetual diſcharge of the old. Without the due quantity of PERSPIRATION, which in a great meaſure depends on our clothing, neither the vegetable or animal can continue in health; a plant whoſe *perſpiration* is ſtopt becomes ſickly and dies; and an egg whoſe ſhell has been covered with a varniſh, and the *perſpiration* ſtopt by this means, will produce no living animal, either by the application of common heat, or that of incubation from the hen. The celebrated SANCTORIUS affirms, that the inſenſible perſpiration alone diſcharges more than all the ſenſible evacuations together; and that the proportion of this to all the other evacuations, is as 5 to 3: though this proportion varies in different ages, climates, and conſtitutions, yet is it of ſuch importance in all, that where it is in any conſiderable degree deficient, a diſeaſed ſtate of the body muſt enſue. The matter of *inſenſible perſpiration*, or in other words, the ſubtile vapour that is continually exhaling from the ſurface of the body, is not ſecreted by any particular glands, but ſeems to be derived wholly from the extremities of minute arteries, that do not terminate in veins, and are every where diſperſed on the ſurface. Theſe *exhaling veſſels* are eaſily demonſtrated in the dead ſubject, by forcing water into the arteries; for then ſmall drops exude from all parts of the ſkin, and raiſe up the cuticle, the pores of which are cloſed by death; and in the living ſubject, a looking-glaſs placed againſt the ſkin, is ſoon obſcured by the vapour. When the perſpiration is by any means increaſed, and ſeveral drops that were inſenſible when ſeparate, are united together, they form upon the ſkin thoſe viſible drops called *ſweat*. This particularly happens after much exerciſe, or whatever occaſions an increaſed determination of fluids to the ſurface of the body; a greater quantity of perſpirable matter being in ſuch caſes carried through the paſſages that are deſtined to convey it off.

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* Vide Sect. IX. on the Neceſſity of a due Quantity of Animal Heat to ſupport the Vital Functions, p. 93.

Now the reaſon of the propriety of *fleecy hoſiery* in *ſummer* is, that though it promotes the perſpiration, it equally favours its *evaporation:* and we know that *eva-*

poration produces *poſitive cold*, the *aqueous diſcharge* being the means deſigned by Nature for carrying off the ſuperabundant heat * whether ariſing from climate, exerciſe, or fever.

In CHILDREN, where the food is continually combining with oxygen, and the fibres are irritable, it is of the utmoſt conſequence to keep the body temperate, but never to ſuffer it to get *chilled*. Thus, without being enervated, they may eſcape the bad conſequences ariſing from the ſudden changes in this inconſtant climate; for it is not true, that cold hardens *children* as it hardens *ſteel*. If delicate children are ſubject to diſeaſes and danger in ENGLAND, to which they would not be ſubject in the warmer climate of ITALY, is it not evident that *the difference* between the climate of ENGLAND and ITALY is the cauſe of theſe diſeaſes and dangers? I firmly believe, ſays Dr. BEDDOES, that the greateſt mortality is among thoſe children who are hardily brought up. Nearly one third of the poor, born in this iſland, ſink into the tomb, as ſoon almoſt as they have catched a few glimpſes of the light of heaven. And even when they have weathered out the early inclemencies of their ſtation, unleſs they afterwards wear warm and comfortable clothing *, they enjoy no ſuch advantage of freedom from *pulmonic complaints* as we are taught to imagine. Among the peaſantry of *Warwickſhire* and *Staffordſhire*, I am creditably told that *conſumptions* are not leſs frequent, than among the better order of people who are more delicately bred up.

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* Vide Sect. X. p. 96. "*on the Means* NATURE *employs to rid herſelf* "*of too much internal Heat.*" When dogs are exerciſed, who do not perſpire, they carry off the ſuperabundant heat by the *kidneys*, as well as by the *tongue*.

FAT PEOPLE need a leſs warm raiment than thoſe that are lean; for oil, as being a bad conductor of heat, acts as a fleecy hoſiery waiſtcoat, reflecting back the vital warmth. Here we cannot but admire the benevolent care of PROVIDENCE to the lower order of animals, by giving the whale, the bear, and other animals who inhabit the colder climates, a deep covering of fat.

OLD PEOPLE, as requiring *abundant excitement*, ought more eſpecially to be warm clad, and rather to exceed, than to be deficient in the quantity of their clothing, and to wear that which affords them the greateſt warmth with the leaſt poſſible weight. They will not then be liable to be injured by ſitting all day in the chimney corner, breathing an unwholeſome air, and in a current of wind. A perſon ſufficiently clothed with the *fleecy hoſiery* next his ſkin may wear any ſlight ſubſtance for ornament above it, and will, I am certain, feel more comfortable even at ſome diſtance from the fire, than when he was ſcorching on one ſide, and felt half frozen on the other.

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* No people are better clothed than the *farmers* in this iſland, who uſually enjoy *rude health*.

The under garment of *fleecy hoſiery* ought to be frequently changed, as it promotes the perſpiration, and is continually abſorbing it. Diſeaſes of the ſkin are chiefly owing to want of cleanlineſs. They may indeed proceed from other cauſes; but they ſeldom continue long where cleanlineſs prevails. To the ſame cauſe muſt we impute the various kinds of vermin which infeſt the human body, &c. Theſe may always be baniſhed by cleanlineſs alone, and wherever they abound, we have every reaſon to believe it is neglected. It is remarkable that, in moſt eaſtern countries, cleanlineſs makes a great part of their religion. Indeed the whole ſyſtem of the Jewiſh laws has a manifeſt tendency to promote cleanlineſs. Whatever pretenſions people make to politeneſs and civilization, I will affirm, that as long as they nenegleƈt cleanlineſs and appear naſty, they are ſtiled Goths and barbarians. Cleanlineſs is certainly agreeable to our nature. It ſooner attraƈts our regard than even finery itſelf, and often gains eſteem where that fails. It is an ornament to the higheſt as well as the loweſt ſtation, and cannot be diſpenſed with in either.

Few things are more unreaſonable, than the dread of cleanlineſs in ſick people. They had rather wallow in all manner of filth, than change a tatter of their apparel. Yet how refreſhed, how cheerful, how comfortable do people feel when in health upon being ſhaved, waſhed, and ſhifted! If cleanlineſs be proper for perſons in health, it is certainly more ſo for the ſick. By being negleƈted the ſlighteſt diſorders are often changed into the moſt *malignant*. The ſame miſtaken care which prompted people to prevent the leaſt admiſſion of *freſh air* to the ſick, ſeems to have induced them to keep them dirty *. If the *fleecy*

hoſiery

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* Dr. Buchan.

I here take my final leave of the *Domeſtic Medicine*, a work certainly of merit: yet I cannot help remarking, that the benevolent author of it has idly attempted to make ignorant old women ſkilful *praƈtitioners*, and that

PHYSIC

hoſiery waiſtcoat was changed on going to bed, which is the time we are in the habit of being expoſed to cold, there can be no danger of catching cold, nor can there be any impropriety of doing this at leaſt twice a week in the ſummer, and once in the winter. The only caution neceſſary, is to ſee, previous to its being put on, that it contains no dampneſs.

PHYSIC WITHOUT PHILOSOPHY is mere QUACKERY, and THE DESTRUCTION OF THOUSANDS. Vide Law II. *On the State of Exhauſtion* produced in the irritable Fibre by the *injudicious* adminiſtration of STIMULI.

The diſcharge from the ſkin is, 1ſt, two parts *fixed air*; and, 2dly, one part *azotic air*; and, 3dly, a quantity of *aqueous fluid*, containing the *different ſalts* of the body.

The ſurface of the body is alſo found to ſeparate the *oxygen air* from its combination with *azotic*, and to imbibe it.

Theſe diſcoveries, begun by Mr. CRUICKSHANKS, and confirmed by Mr. ABERNETHY, both eminent teachers of anatomy in *London*, have led ſome able phyſiologiſt of the preſent day to ſuſpect that, 1. *fixed air*, 2. *azotic air*, and, 3. *water*, are ſent forth at each expiration from THE LUNGS, while the *oxygen air*, in lieu of theſe, is imbibed by the blood, and they have inculcated a new theory of reſpiration.

Experiments, we are informed, have been inſtituted by Dr. BEDDOES at the Hot Wells, Briſtol, and Dr. THORNTON in London, to aſcertain the products of *expiration* after *inhaling* different kinds of air, which will probably decide this controverſy. (Compare with this note Sect. VI. Part II. ON RESPIRATION.

OF MENTAL STIMULI.

SECT. XIV.

OF VISION.

WHEN the ſun riſes on the face of the earth, *all nature* ſeems to have received *a new creation.* What *majeſty!*—What *ſplendour!*—What *beauty!*

We will attempt, in as familiar a manner as poſſible, to explain to the attentive reader, *the nice mechaniſm* by which the ſight is thus capable of communicating to the mind theſe *lively*, *varied*, and *abundant perceptions.*

In relation to the following law, "*that the rays of light are refracted* (or turned inwards) *according to the denſity of the medium through which they paſs*," our eyes conſiſt of 3 *diſtinct humours* of *different denſities*, each lodged in a tranſparent capſule, viz.

1. The EXTERNAL, or AQUEOUS;
2. The CENTRAL, or CRYSTALLINE; and
3. The INWARD, or VITRIOUS.

Becauſe

Becauſe light is ſubjected alſo to another law, the law of *reflection*, a DARK MEMBRANE lines the whole of the inſide of the globe.

The OPTIC NERVE expands itſelf over the concave bottom of this darkened ſphere, whoſe fibres, in a collected body, terminate obliquely * in the brain.

At the fore part of the eye there is, as it were, a *partition*, in the center of which a round orifice, called the PUPIL †, is ſeen, which contracts or dilates itſelf, to admit of more or a leſs degree of light, by means of the muſcular fibres of the IRIS or UVIA ‡.

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* This might be adduced as a beautiful illuſtration of the beneficent intention of THE DIVINE ARCHITECT. A vein and artery accompany this nerve, ſo that when an object ſtrikes upon it, ſight is prevented. From the obliquity of the entrance of the optic nerve this does not often happen, but may be made to appear, if you form a dark ſpot on a piece of paper, and ſhutting one eye, turn this paper about, until the ſpot ſtrikes on the trunk of the optic nerve, when it will immediately diſappear.

† This is the *ſmall black circle* in the middle of the eye.

‡ Called *uvia* from its ſuppoſed reſemblance to a grape, being uſually grey or black. This part is ſurrounded *externally* by the white of the eye, and *internally* by the pupil. The iris or uvia of a greyhound being put into an alkaleſcent mixture by Dr. HAIGHTON, the *longitudinal fibres* were rendered viſible. Theſe *ſympathize* with the optic nerve: for in gutta ſerena, or decay of energy in that nerve, the pupil remains unaltered in dimenſions, however the light may vary. The *ſympathy* of parts was before ſhewn, when diſcourſing on the ſynchronous action of the oppoſite ſides of the heart, and is alſo diſplayed, when we irritate the noſtrils, and excite into action the muſcles of expiration, or when exciting the ſtomach by an emetic, the abdominal muſcles, to favour each rejection, are thrown into convulſive efforts.

Six muscles* are placed behind, ſo as to turn this beautiful and uſeful organ on every ſide.

Thus have we a perfect CAMERA OBSCURA, with its different lenſes; and the image painted in the darkened chamber of the eye (owing to the reflexion of the rays of light from the objects around), by affecting the optic nerve, preſents to the mind the varied and agreeable impreſſion.

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* The four right muſcles ariſe near together from the bottom of the orbit, where the optic nerve enters, which they ſurround. The *one* lifts the eye directly upwards, *another* turns it downwards, a *third* draws the ſight toward the noſe, and the *fourth* turns it the contrary way. They terminate each in a broad, flat, and very white tendon, which covers all the fore part of the eye, up to the circle of the *cornea* (or outer convex capſule of the aqueous humour); and their white and ſhining tendons form that enamelled like part which ſurrounds the *coloured circle*, and which is, from its colour, named *the white of the eye*, or the *tunica albuginea*, as if it were abſolutely a diſtinct coat.

So perfectly balanced are theſe muſcles, that if they act all at once the eye is immoveably fixed. So that ſometimes in an operation the eye is found more firmly ſet than it could be either by inſtruments or the finger.

The two oblique muſcles deſerve alſo particular attention. The *inferior oblique* ariſes from the orbit, and obliquely deſcends into that cavity to be inſerted under the eye-ball; and the *ſuperior oblique*, on the contrary, ariſes along with the recti muſcles, but ſends forth a long tendon, which paſſes through a ring near the noſe, and by this beautiful contrivanee, it gets inſerted into the upper part of the eye-ball. They project the eye forward, as when we ſtrain to ſee diſtant objects.

Brutes have *another muſcle* not found in our eyes. A ſurgeon attempting to extract the cataract from the eye of a blind horſe, diſcovered this by accident, for as ſoon as the eye was touched, it receded deep into the head. This could be effected only by this *ſeventh* muſcle; which therefore ſeems to be provided for defending the eye, by drawing it thus into the orbit, in creatures who have no hand, like us, to ſkreen the eye upon the approach of danger.

Should it be inquired, " *in what way* the optic nerve conveys the image of the objects around; and whether this ariſes from *vibration*, or *the motion* of *ſome fluid?*" The anſwer is, it muſt be confeſſed, of very difficult ſolution. But it ſeems highly improbable that a *ſoft inelaſtic cord*, like a nerve, can *vibrate*, and no *inert heavy fluid* can *equal the quickneſs of perception*.

We are then induced, ſays the celebrated naturaliſt Bonnet, to admit that there is a ſubtle fluid in the nerves, whoſe tenuity prevents our ſeeing it; and which ſerves alike for the propagation of ſenſible impreſſions, as muſcular motion. The *inſtantaneouſneſs* of this propagation, and *ſome other phænomena*, indicate that there is *a certain analogy* between *this fluid* and the *electric fluid* *.

As we know, indeed, that a ſixth part of the whole maſs of blood is driven to the brain from the heart in an *oxygenated* form, and quickly returns thence *unoxygenated* †, and is as ſpeedily ſupplied by freſh *oxygenated*

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[*] Vide Part II. Sect. XII. on *Muſcular Motion*.

[†] Vide the repreſentation of the heart, and obſerve the 2 *carotid arteries*, whoſe blood is returned by the 4 *jugulars*.

blood, it would be a pleaſing, but difficult, attempt to prove that this quantity of blood, when paſſing into ſo ſmall an organ as the brain, cannot be intended by frugal NATURE ſolely for nouriſhment, and the generation of vital heat, but muſt emit its caloric to be formed by the action of the brain into the *electric fluid.*

As *the nerves* of ſight, and the other organs of ſenſe, terminate in THE BRAIN, we have the higheſt reaſon to believe that THE SOUL is ſeated there.

A ſubſtance, therefore, indifferent to motion and reſt, is related to a ſubſtance that thinks, and though unagitated by external impreſſion, can generally at will regain the former connection. From this ſurpriſing bond there ſprings a reciprocal commerce between two diſtinct beings, a kind of action and reaction, which conſtitutes the life of organized ſentient beings.

The brain may therefore be compared to a *cart blanch,* receiving every impreſſion; and to a *cabinet,* wherein the different portions of the univerſe are painted in miniature, and may be drawn out at pleaſure.

SECT. XV.

OF HEARING.

As we ſaw different humours in the eye in relation to the laws of light, ſo we find a no leſs complicated ſtructure of the ear in reference to the vibrations of the air. The uſes, however, of the ſeveral parts forming the ear is not ſo well underſtood: but it behoves us, in contemplating the work of THE CREATOR, not to queſtion the utility of any part; but to ſay, we find it here in this particular form, and therefore it muſt have its uſe.

The tremulous motions of the air are firſt received by the external ear. In men this part is much flatter than in brutes, but formed with certain folds, or inequalities, conſtituting a kind of winding paſſage for the air into the canal, which leads to the internal part of the ear.

THIS CANAL by its form would probably invite inſects to make a lodgment in it, were it not defended by a tenacious and bitter ſubſtance, called the wax of the ear. But in birds, whoſe organs of hearing are ſufficiently defended, no ſuch ſecretion is obſerved.

Through this canal the pulſations of the air are conveyed to a membrane, called MEMBRANA TYMPANI, ſtretched acroſs it, and dividing the *external* from what is called by anatomiſts the *internal ear*.

From the tympanum, or drum, is an opening into the mouth. On one ſide of this paſſage, called THE EUSTACHEAN TUBE, there is a cartilage, to which there is affixed a muſcle, by which the paſſage may be varied, juſt as the muſcular fibres of the uvia vary the dimenſion of the pupil for the admiſſion of light. This opening is of ſo much importance towards hearing, that thoſe who are in ſome meaſure deaf, are generally obſerved to open their mouths when they liſten, whereby the vibrations of the air have a freer paſſage to the tympanum *.

Within the tympanum are lodged FOUR SMALL BONES ſubſervient to the office of hearing. Theſe communicate with certain *bony* and *winding* CAVITIES † lined on their inſide with NERVOUS FILAMENTS, which go to the brain by a common trunk.

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* The charming contrivance for preventing the food from paſſing into the wind-pipe by means of a flexible covering, was before obſerved, and we may remark here a no leſs kind intention in PROVIDENCE towards man in furniſhing him with *the uvula,* which, as the food is paſſing into the œſophagus, is drawn back, and cloſes the opening into the noſe and Euſtachean tube. Animals who are prone, not being ſubject to have any of their aliment paſs through the noſe, want therefore *this defence*.

† To wit, the *veſtibulum, ſemicircular canals,* and *cochlea*.

It is generally believed, that the *tympanum* of the ear vibrates mechanically, when expoſed to audible ſounds, like the ſtrings of one muſical inſtrument, when the ſame notes are ſtruck upon another. Nor does this opinion ſeem improbable, as the muſcles and bones of the ear ſeem adapted to increaſe or diminiſh the tenſion of the tympanum for the purpoſes of mechanical vibrations.

But it appears from diſſection, that *the tympanum*[*] is

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[*] The ſituation of the *membrana tympani* is nearly horizontal in men and in brutes, which is the beſt poſition to receive ſounds reverberated from the earth. In *them* it is *concave* outward; but in *birds* it is *convex* outward, ſo as to make the upper part of it nearly perpendicular to the horizon, which is beſt fitted for the receiving of ſounds in the air. *This membrane* does not entirely cloſe the paſſage, but has, ſays CHESELDEN, on one ſide a ſmall aperture covered with a valve. I found it, ſays he, once half open in a man that I diſſected, who had not been *deaf*; and I have ſeen a man ſmoak a whole pipe of tobacco through his ears, which muſt go from the mouth, by the paſſage of the Euſtachean tube, through the tympanum; yet this man *heard* perfectly well. Theſe caſes occaſioned me to break the tympanum in both ears of a dog, and it did not deſtroy his hearing, but he was much ſhocked at any loud ſounds. In very young children I have always found this membrane covered with a *thick mucus*, which ſeems kindly provided for them, to prevent loud ſounds from affecting them too much. A gentleman well known in this city, having had *four* children born deaf, was adviſed to lay bliſters behind the ears of the next children he might have, which he did to *three* which were born

not the immediate organ of hearing, but that like *the humours of the eye*, it is only of uſe to *prepare* the object for the immediate organ. For THE AUDITORY NERVE is not ſpread upon the tympanum, but upon the VERTIBULUM, and COCHLEA, and SEMICIRCULAR CANALS of the ear; while between the tympanum and the expanſion of the auditory nerve the cavity is ſaid, by Dr. Meckel, to be filled with *water*; as he had frequently obſerved by freezing the heads of dead animals before he diſſected them; and water being a more *denſe fluid*

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afterwards, and every one of theſe heard perfectly well. It ſeemed not unreaſonable to ſuppoſe that too greater a quantity of this mucus upon the drum, or the depoſition of coagulable lymph thrown out by inflammation, might be the cauſe of deafneſs in the *four* children, and that the diſcharge made by the bliſters in the *three* latter caſes, was the cauſe of their *eſcaping* the ſame misfortune. From theſe, and other like caſes, it may be concluded, that the *membrana tympani*, though uſeful in hearing, is not the ſeat of that ſenſe; and if any diſeaſe in that membrane ſhould *obſtruct* the paſſage of ſounds to the *internal parts* of the ear, which are the ſeat of that ſenſe, an artificial paſſage through that membrane might recover hearing, as the removing the *chryſtaline humour*, when that obſtructs the light, recovers ſight. Some years ſince a malefactor, who was deaf, was pardoned on condition that he ſuffere dthis experiment. As ſoon as this was publicly known, Mr. Cheselden, the lecturer on anatomy and ſurgery, and ſurgeon of St. Thomas's Hoſpital, was hooted and inſulted in the ſtreets, and having entered the theatre, the play was arreſted by the cry of DRUM! DRUM! and he was obliged to leave the theatre, ſo violent at all times has been the *indignation* againſt men, who are inclined, from a philoſophic conviction of truth, to *innovate*, or rather I might ſay, to *improve* the routine of things, and he was conſtrained by the public voice to deſiſt from the attempt, and it is probable that the world will loſe for ever the benefits that might have reſulted from this experiment!

than air, is much better adapted to the propagation of vibrations.

I ſhall not expatiate on *theſe recluſe parts*; only there is one ſpecial contrivance of the nerves miniſtering to this ſenſe of hearing, which I think ought not to be paſſed by. One of the branches of the auditory nerves is diſtributed partly to the muſcles of the *ear*, partly to the *eye*, partly to the *tongue* and inſtruments of *ſpeech* *, and inoſculated with the nerves that go to the *heart* and *breaſt*. By which means there is an admirable and uſeful *conſent* between theſe parts of the body; it being natural for moſt animals, upon hearing any ſtrange ſound, to erect their ears, to open their eyes, and to be ready with the mouth to call out, or utter what the preſent occaſion ſhall dictate. And accordingly it is very common for moſt animals, when ſuddenly ſurpriſed in ſleep with any loud noiſe, preſently to ſhriek and cry out, and diſplay a great palpitation of the heart.

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* Every one in his childhood has repeatedly bit a part of the glaſs or earthen veſſel, in which his food has been given him, and has thence had a very diſagreeable ſenſation in *the teeth*, which ſenſation was deſigned by nature to prevent us from exerting them on objects harder than themſelves. The jarring ſound produced between the cup and the teeth is always attendant on this diſagreeable ſenſation: and ever after, when ſuch a ſound is accidentally produced by the conflict of two hard bodies, we feel by aſſociation of ideas the concomitant diſagreeable ſenſation in our teeth. Others have, in their infancy, frequently held the corner of a ſilk handkerchief in their mouth, whilſt their companions in play have plucked it from them, and have given another diſagreeable ſenſation to their teeth, which has afterwards recurred on running the finger along thoſe materials. Dr. DARWIN.

A conſent of parts may *alſo* exiſt, where the nerves cannot be traced as connected together. Vide note *, p. 132.

Hearing is a ſenſe much more neceſſary to man than to animals. With theſe it is only a warning againſt danger, or an encouragement to mutual aſſiſtance. In man, it is the ſource of moſt of *his pleaſures*; and without which his reaſon would be of little benefit.

A man born deaf muſt neceſſarily be dumb; and his whole ſphere of knowledge will in all probability be bounded only by ſenſual objects. We have an inſtance of a young man, who, being born deaf, was reſtored, at the age of twenty-four, to perfect hearing: the account is given in the Memoirs of the Academy of Science, 1703.

A young man of the town of Chartres, between the age of twenty-three and twenty-four, the ſon of a tradeſman, and deaf and dumb from his birth, recovered his hearing, and in three months, by unremitting diligence, he underſtood what was ſaid to him, and could join tolerably well in converſation. Soon after, ſome divines queſtioned him concerning his ideas of his paſt ſtate;

and principally with reſpect to God, his ſoul, and the morality and turpitude of actions. The young man, however, had not driven his ſolitary ſpeculations into that channel. He had gone to maſs, indeed, with his parents, had learned to ſign himſelf with the croſs, to kneel down and aſſume all the grimaces of a man that was praying; but he did all this without any manner of knowledge of the intention or the cauſe; he ſaw others do the like, and that was enough for him; he led a life of pure animal inſtinct; entirely taken up with ſenſible objects, and ſuch as were preſent, he did not ſeem even to make ſo many reflections upon theſe, as might reaſonably be expected from his ſituation: and yet the young man was not in want of underſtanding; but the underſtanding of a man deprived of all commerce with others is ſo very confined, that the mind is in ſome meaſure totally under the control of its immediate ſenſation.

All nations, even the moſt barbarous, have their inſtruments of *muſic*; and what is remarkable, the proportion between their notes is in all the ſame as in ours. This, however, is not the place for entering into the nature of theſe ſounds, their effects upon the air, or their conſonances with each other. We are not now giving an hiſtory of ſound, but of human perception.

All countries are pleaſed with *muſic*; and, if they have not ſkill enough to produce *harmony*, at leaſt they ſeem willing to ſubſtitute *noiſe*. Without all queſtion, noiſe alone is ſufficient to operate powerfully on the ſpirit; and if the mind be already prediſpoſed to joy, I have ſeldom found noiſe fail of increaſing it into rapture. The mind feels a kind of diſtracted pleaſure in ſuch powerful ſounds, braces up every nerve, and riots in the exceſs. But, as in the eye, an immediate gaze upon the ſun will diſturb the organ; ſo, in the ear, a loud unexpected noiſe diſorders the whole frame, and ſometimes diſturbs the ſenſe ever after.

SECT. XVI.

OF THE TOUCH.

THE peculiar organ of this ſenſe is *the ſkin*, which covers the whole body, it being needful that the ſurface ſhould be provided with this ſenſe, that nothing might come into contact with any part of our body, without being perceived.

If we conſider the ſkin only, and reflect how accurately the mind diſtinguiſhes each particular portion, which is preſſed by the ſeveral parts of any object, how ſurpriſing muſt it appear, that the nerves we find aſſigned to the ſkin, can ſupply ſuch numbers of ſeparate fibres, as are neceſſary for diſtinguiſhing in this manner the action upon each almoſt infinite minute part of ſo very extended a ſurface?

As one office of the ſkin is to be an emunctory, by which the redundancies or effete parts of the blood are thrown forth [*]; for this end it is furniſhed with numerous pores in every part of it. But between theſe pores ariſe, from the external ſurface of the ſkin, NERVOUS PAPILLÆ, very minute and contiguous to each other, by which the office of touch is performed.

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[*] See page 277.

Theſe are defended by *a mucous ſubſtance* * ſpread *between* the EXTERNAL and INTERNAL SKIN, which being every where pierced through by *theſe papillæ*, receives the name of RETE MUCOSUM.

Beſides the pain conſequent upon injuries done to the ſkin, the primary object of ſenſation in theſe PAPILLÆ ſeems to be *hardneſs* and *ſoftneſs*: ſuch bodies as give way to the touch, we call *ſoft*; others, which reſiſt preſſure, ſo as to cauſe the ſkin to yield under them, we call *hard*. And how happily is this ſenſe tempered between the two extremes; being neither too acute nor too obtuſe!

By the touch, we correct the error of viſion. Naturally every object we ſee appears to be within our reach, for a child, who has as yet made but little uſe of his ſenſe of feeling, would equally graſp at the moon as at objects within his reach. Mr. CHESELDEN, having couched a boy of thirteen for a cataract, who had hitherto been blind, and thus at once reſtored him to ſight, has curiouſly marked the progreſs of his recovery. He was, at firſt, couched only in one of his eyes; and, when he ſaw for the firſt time, he was ſo far from judging of diſtances, that he ſuppoſed his eyes *touched* every object that he ſaw, in the ſame manner as his hands might be ſaid to feel them. It may be for this reaſon that we often ſee horſes frighted at things, which they have not become acquainted with by means of their noſtrils, which ſerve them in ſome reſpects like our hands.

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* This gluey matter, ſoon after birth, grows of a *yellow tinge*, which increaſes in our riper age. It is *darker*, as the climate is hot, and as we become more expoſed to it, and under the line it is of a perfect *black colour*, forming the chief contraſt between *black* and *white* men. Dr. BEDDOES, in the preſence of ſome pupils who attended his chemical lectures at Oxford, having directed a *black* to immerſe his hand in diluted oxygenated marine acid, the hand quickly became milky *white*; but the piebald negro reſiſted any further attempts. On the contrary, a French phyſician, it is ſaid, by giving a reverend divine ſilver diſſolved in the nitrous acid, converted him wholly into *a black*. Vide Dr. Beddoes' Works, and La Medicine Eclairée par les Sciences.

It has been remarked, that even brutes are intelligent in proportion to the accuracy of their feeling, or as their extremities approach in reſemblance to the human hand. The horſe and the bull, whoſe feet are covered with callous hoofs, are leſs intelligent than the dog, and the dog is inferior in accuteneſs to the ape, who poſſeſſes a rude kind of hand.

This ſenſe is the peculiar amuſement of infants, and, as we before obſerved, perfects the ſenſe of viſion.

SECT. XVII.

OF PAIN.

But different from this, and conſtituting another ſpecies of *feeling*, are thoſe ſenſations ariſing from different diſturbances in the animal machine.

All theſe various ſenſations are ſo diſtinct one from another, that ſcarce any two parts of the body feel the ſame ſpecies of pain. The *head-ach*, *tooth-ach*, *ear-ach*, though ranged under one general name, are yet very different kinds of ſenſation. The pain which the *bowels* feel in colics, is totally different from any of theſe; and the affection of the ſtomach, called *ſickneſs* *, is peculiar to that part, this organ being liable to other ſpecies of pain alſo. Again, the pain felt *in the breaſt* from the breath being ſtraitened, has no kind of analogy with any of theſe, the breaſt being alſo ſubject to other pains, inflammation, and the like. Nor are the ſeveral modes of pain, to which our periſhing bodies are ſubject in all their diverſe parts, eaſily to be enumerated *. But theſe variations principally merit our attention, as the different ſenſations in the pains the ſame part is ſubject to, may, ſo far as they can be deſcribed, point out the cauſe of each, and direct to the proper methods for removing them.

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* *Sickneſs* ariſes from *ſenſation:* hence it is always preceded by *nauſea.* Van Swieten relates that SYDENHAM was once ſick on ſeeing a putrid dead dog; coming paſt the ſame place *many years* afterwards, he felt a ſimilar inclination to vomit. Hence if we cut the par vagum, the nerve leading to the ſtomach, no ſickneſs can be excited in the dog by the moſt violent emetics.

Theſe *ſtimulate* in proportion to their intenſity and the ſenſibility of the part affected, and accordingly convey their impreſſion to the ſenſorium, which has a power even to ſtifle a part of the ſtimulus by reſignation, or elſe add to it by the impatience of the will.

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[*] It is not meant that *the nerves* are different, but that they are like the nerves adminiſtering to taſte, differently affected according to the ſtimuli applied; and poſſeſs alſo a difference in ſenſation, ariſing from the variety of ſtructure in thoſe organs to which they are connected. Vide the Sect. ON THE SENTIENT PRINCIPLE.

SECT. XVIII.

OF THE SENSATION OF HEAT AND COLD.

THERE are many experiments in chemical writers, that evince the exiſtence of HEAT *as a fluid element*, which covers and pervades all bodies, and is *attracted* by the *ſolutions* of ſome of them, and is *detruded* from the *combination* of others. Thus from the *combinations* of metals with acids, and from thoſe *combinations* of animal fluids, which are termed ſecretions, *this fluid matter of heat* is given out amongſt the neighbouring bodies; and in the *ſolutions* of ſalts in water, or of water in air, it is *abſorbed* from the bodies that ſurround them; *whilſt in its facility in paſſing through metallic bodies, and its difficulty in pervading reſins and glaſs, it reſembles the properties of the* ELECTRIC AURA; *and is like that excited by friction, and ſeems like that to gravitate amongſt other bodies in its uncombined ſtate, and to find its equilibrium* *.

There is no circumſtance of more conſequence in the animal œconomy than a due proportion of this fluid of heat; for the digeſtion of our nutriment, and the converſion of it into chyle in the bowels, and the proper qualities of all our ſecreted fluids, as they are produced partly by animal and partly by chemical proceſſes, depend much on *the quantity* of heat; the exceſs of which, or its deficiency, alike give us pain, and induces us to avoid the circumſtances that occaſion them.

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* Vide page 282.

And in this the perception of heat eſſentially *differs* from the perceptions of the ſenſe of touch, as we receive pain from too much preſſure of ſolid bodies, but none from the abſence of it. It is hence conjectured that our CREATOR has provided us with *the nerve of touch* ‡, as diſtinct in itſelf as the optic, or any other nerve of ſenſe, and *a ſet of nerves* for the reception of *this fluid*, which anatomiſts have not yet attended to.

There is another circumſtance which would induce us to believe, that the perceptions of heat and cold do not belong to the organ of touch; ſince *the teeth*, which are the leaſt adapted for the perceptions of ſolidity and figure, are the moſt ſenſible to heat or cold; whence we are forewarned from ſwallowing thoſe materials, whoſe degree of coldneſs or of heat would injure our ſtomachs.

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‡ Vide note *, p. 295, and the Sect. ON THE SENTIENT PRINCIPLE. This ſubject deſerves to be more fully conſidered by both anatomiſts and phyſiologiſts.

The following is an extract from a letter of Dr. Darwin of *Shrewſbury*, when he was a ſtudent at Edinburgh, to his friend Dr. Darwin of *Derby*.

Dear Sir,

I made an experiment yeſterday in the hoſpital, which much favours your opinion, "*that the ſenſation of* heat *and of* touch[*] *depend on different ſets of nerves.*"

A man who had lately recovered from a fever, and was ſtill weak, was ſeized with violent cramps in his legs and feet; which were removed by opiates, except that one of his feet remained inſenſible.

Dr. Ewart, of *Bath*, pricked him with a pin in five or ſix places, and the patient declared he did not feel it in the leaſt, nor was he ſenſible of a very ſmart pinch.

I then held a *hot iron* at ſome diſtance, and brought it gradually nearer, till it came within three inches, when he aſſerted he felt it quite diſtinctly.

I have the honour to be, &c. &c.

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[*] Might not this difference ariſe from the ſenſibility of the part being in ſome degree reſtored by the application of heat? Vide note *, page 142.

SECT.

SECT. XIX.

OF SMELLING.

THE infinitely ſmall particles that are continually detached from the ſurface of odoriferous bodies, float in the air, which tranſports them every where, and being drawn into the noſtrils by the breath, are applied to the membrane that is diſtributed in the bony cavity in the inſide of the noſe. THIS MEMBRANE is totally covered with infinite ramifications and convolutions of the OLFACTORY NERVES.

The great CREATOR, ever attentive to the eaſe and convenience of his creatures, has furniſhed the noſtrils with a number of *glands*, or ſmall arteries, which ſecrete a thick mucus, which defends the nerves from the ſlighter action of the air, or the too powerful ſtimulus of acrid odours.

Of all the ſenſes, perhaps, there is not one in which man is more inferior to other animals than in that of *ſmelling*. A dog ſcents various kinds of game at conſiderable diſtances; and, if the fact were not confirmed by daily experience, it could hardly gain credit, that he can trace the odour of his maſter's foot through all the winding ſtreets of a populous city!

In the ſelection of food, men are greatly aſſiſted, even in the moſt luxurious ſtate of ſociety, by the ſenſe of ſmell. By *ſmelling* we often reject food as noxious, and will not riſk the other teſt of taſting. Victuals, which have a putrid ſmell, as equally offenſive to our noſtrils as hurtful to our conſtitution, we avoid with abhorrence; but we are allured to eat ſubſtances which have a grateful and ſavoury odour. The more frequent and more acute diſcernment of brutes in the exerciſe of this ſenſe is chiefly owing to their freedom, and to their uſing natural productions alone. But men in ſociety, by the arts of cookery, by the unnatural aſſemblage of twenty ingredients in one diſh, blunt, corrupt, and deceive, both their ſenſes of *ſmelling* and of *taſting*.

It is not unworthy of remark, that, in all animals, the organs of *ſeeing*, *ſmelling*, and *taſting*, are uniformly ſituated very near each other. Here the intention of NATURE is evident. The vicinity of theſe three ſenſes form a *triple* guard in the ſelection of food.

But aſſiſtance in the choice of food is not the only advantage that men and other animals derive from the of *ſmelling.* When our ſenſes are not vitiated by unnatural habits, they are not only faithful monitors of danger, but convey to us the moſt exquiſite *pleaſures.* The fragrance of a roſe, and the perfume of many other flowers, is not only pleaſant, but gives a refreſhing and delightful *ſtimulus* to the whole ſyſtem, and may be conſidered therefore often as a ſpecies of wholeſome excitement.

SECT. XX.

OF TASTE.

The ſmell, as was before obſerved, has great connection with the taſte. We often are directed by it in judging of our food; and that part of taſte which we uſually call *flavour*, is a mixed kind of ſenſation compounded after ſome manner from both. By the communication between the noſe and mouth, the olfactory nerves ſeem capable of being affected that way; inſomuch, that perſons who are at the pains to prevent the acceſs of air by the noſtrils, ſwallow nauſeous draughts without taſting them.

The gustatory nerves, by which this ſenſation is received, riſe upon the body of the *tongue* in a manner ſomewhat ſimilar to thoſe in the ſkin; for PAPILLÆ more viſible than thoſe of the ſkin (otherwiſe alike) appear in thoſe parts of the tongue that are endued with this ſenſe. *Theſe* are always erected on the application of ſapid or ſtimulating ſubſtances. This elevation and extenſion of the *papillæ*, by bringing larger portions of the nerves into contact with the ſubſtances applied to the tongue, give additional ſtrength to the ſenſation, and enable us to judge with greater accuracy concerning their nature and qualities. The *ſaliva*, which perpetually moiſtens the tongue, is a liquor, which, though inſipid itſelf, is found in all animals to be a very powerful ſolvent. Every ſubſtance applied to the tongue is partially diſſolved by the ſaliva before the ſenſation of taſte is excited. And hence when the tongue is rendered dry by diſeaſe, or any other cauſe, the ſenſe of taſte is either vitiated or totally deſtroyed.

The ſenſes of *ſmell* and *taſte* in many other animals greatly excel thoſe of mankind, for in civilized ſociety, as our victuals are generally prepared by others, and are adulterated with ſalt, ſpice, oil, and empyreuma, *we* do not heſitate about eating whatever is ſet before us, and neglect to cultivate theſe ſenſes: whereas *other animals* try every morſel by the *ſmell*, before they take it into their mouths, and by the *taſte* before they ſwallow it; and are led each to his proper nouriſhment by his organs of ſenſe.

Nevertheleſs we may obſerve that *children*, having abundant excitability, are naturally inclined towards thoſe foods which contain but little ſtimuli. And, on the contrary, *thoſe* who are *more advanced in life*, and whoſe excitability is blunted, are fond of the moſt poignant diſhes. Every one muſt remember how great a pleaſure he found in ſweets and milk while a *child*. As he *grew older* he inſenſibly calls to his aſſiſtance ſpices, ſalts, and aromatics; and delights in thoſe taſtes which in childhood he was unable to endure.

SECT. XXI.

OF IMAGINATION.

An animal may be ſaid to fill up that ſphere which he can reach by his ſenſes; and is actually large in proportion to the ſphere to which its organs extend.—By *ſight*, man's enjoyments are diffuſed into a wide circle;—that of *hearing*, though leſs widely diffuſed, nevertheleſs extends his powers;—the ſenſe of *ſmelling* is more contracted ſtill;—and the *taſte* and *touch* are the moſt confined of all. Thus man enjoys *very diſtant objects*, but with *one ſenſe only*; more *nearly* he brings *two ſenſes* at once to bear upon them; his ſenſe of *ſmelling* aſſiſts *the other two*, and at its own diſtance.

Each ſenſe, however, the more enlarged its ſphere, the more capable it is of making *combinations*; and is, conſequently, the more *improveable*. Refined imaginations, and men of ſtrong minds, take more pleaſure, therefore, in improving the delights of the *diſtant ſenſes*, than in enjoying ſuch as are ſcarce capable of improvement.

By combining *the objects* of the *extenſive ſenſes*, all the arts of poetry, painting, and harmony, have been diſcovered; but the *cloſer ſenſes*, if I may ſo call them, ſuch as ſmelling, taſting, and touching, are, in ſome meaſure, as ſimple as they are limited, and admit of little variety. *The man* of *imagination* makes a great and an artificial happineſs, by the pleaſure of *altering* and *combining*; the *ſenſualiſt* juſt ſtops where he began, and cultivates only thoſe pleaſures which he cannot improve. The *ſenſualiſt* is contented with thoſe enjoyments that are already made to his hand; but *the man* of *refined pleaſure* is beſt pleaſed with happineſs of his own creating.

SECT. XXII.

OF ANGER.

Anger, in its operation on the animal œconomy, is one of the ſtrongeſt of the *mental ſtimuli*. It rouſes the heart and arteries into greater action, produces an ardent glow over the whole body, but more eſpecially in the face; the eyes look red, the voice is loud, and the muſcular powers are increaſed: hence gout, palſy, &c. have been all removed by violent paroxyſms of rage.

But this ſtimulus is uſually too active in its operation to be friendly to health.

Where revenge cannot be indulged, a paleneſs of the ſkin and cheeks quickly ſucceeds, the voice faulters, and the limbs are affected with tremor. But where the object is perpetually calling for reſentment, and this paſſion is not conſumed in violent action, it then gives tone to the muſcular fibre.

Upon the Britiſh fleet coming into the Bay of *Hieres* (February 1744), our men, ſays Mr. IVES, underſtood that the enemy's fleet and ours were ſoon to engage.

There appeared, not only in the *healthy*, but alſo in the *ſick*, the higheſt mark of ſatisfaction and pleaſure, and *theſe laſt mended ſurpriſingly daily*, inſomuch that on the 11th of February, the day we engaged the combined fleets of France and Spain, we had not above four or five but what were at their fighting quarters.

The Philadelphia militia who joined the remains of General *Waſhington*'s army, in December 1776, and ſhared with them, a few days afterward, in the capture of a large body of *Heſſians* at TRENTON, conſiſted of 1500 men, moſt of whom had been accuſtomed to the habits of a city life. Theſe men ſlept in tents and barns, and ſometimes in the open air, during the uſual colds of December and January; and yet there were only two inſtances of ſickneſs, and only one of death, in that body of men in the courſe of near ſix weeks, in thoſe winter months. This *extraordinary healthineſs* of ſo great a number of men, under ſuch trying circumſtances, can only be aſcribed to the vigour infuſed into the body from the ſtrong paſſions of the mind rendering it inſenſible to the ordinary cauſes of diſeaſe.

Militia officers and ſoldiers, who enjoyed good health during the campaign, were often affected by ſevers and other diſorders, as ſoon as they returned to their reſpective homes. I knew one inſtance, ſays Dr. Rush, of a militia captain, who was ſeized with convulſions the firſt night he lay at eaſe, after having ſlept ſeveral months on a mattraſs upon the ground. Theſe affections appear to have been produced only by the ſudden abſtraction of that tone in the ſyſtem which was excited by a ſenſe of danger, and the other invigorating objects of a military life.

The patience, firmneſs, and magnanimity, with which the officers and ſoldiers of the American army endured the complicated evils of hunger, cold, and nakedneſs, can only be aſcribed, continues this ſagacious phyſician, to an inſenſibility of body, produced by an uncommon tone of mind, excited by the love of *liberty* and the *hatred* of the enemy: for the war was carried on by the Americans againſt a nation, to whom they had long been tied by the numerous obligations of conſanguinity, laws, religion, commerce, language, intereſt, and a mutual ſenſe of national glory; the *reſentment* of the Americans roſe of courſe, as is uſual in all diſputes, in proportion to the number and force of theſe ancient bonds of affection and union. On this ſame principle it is, that ſavages, to ſatiate their revenge, bear with uncommon patience, and without injury, all the ſeverities of cold and hunger, and have been known to wait even eight or ten months in ambuſh to deſtroy an adverſary.

SECT. XXIII.

ON ENTHUSIASM.

It is well known that perſons under ſtrong prepoſſeſſions of mind, have expoſed themſelves[*] to extreme bodily tortures without expreſſion of pain, and have alſo endured long faſtings, the extremities of heat and cold, the infection of contagious diſtempers, and other hazardous experiments, without feeling the conſequences that would moſt probably have taken place, had not the nervous feelings been more forcibly pre-occupied.

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[*] *Hoffman. Affect. maniac. ſenſuum aug. ſtipat.* Tolerantia inediæ atque algoris mirabilis. Boerhaavii Aphoriſm. 1120.

SECT. XXIV.

OF LOVE.

Love, the moſt univerſal and grateful paſſion of human nature, which, in general, neither aſſumes the violence of *anger*, nor ſinks into the depreſſion of *grief*, may be conſidered as a *temperate ſtimulus*; but in its viciſſitudes and extremes, it may acquire the impetuoſity of the *firſt*, or the deſpondency of the *latter*.

In *love*, in *propitious love*, the heart beats with joy; vivacity cheers the countenance, the eye is brilliant, ſociety is courted, language is animated, and vigour augmented.

But when this paſſion has taken deep poſſeſſion of the heart and ſoul, with a *dubious*, or *adverſe return*, it is expreſſed by deep involuntary ſighs; every incident that excites emotion, eſpecially the tender emotions of ſympathy, make the heart palpitate, and ſuffuſes the face with faint bluſhes; the voice is low, languid, ſlow, or faultering; the eyes are downcaſt or penſive; and the breaſt heaves and falls, like the motion of gently diſturbed waters. Solitude, ſhades, and evening walks, are frequented; objects of pity are cheriſhed, and all the effuſions of ſentiment are tender, ſedate, and ſympathetic. The face at length becomes pale and wan, the eyes ſink, the appetite for food is obliterated, and frightful dreams invade the tedious night.

SECT. XXV.

OF SOCIAL AFFECTION.

THIS is the mildeſt and moſt agreeable of all the mental ſtimuli.

SWEET is the breath of morn, her riſing ſweet,
with charm of earlieſt birds: pleaſant the ſun,
when firſt on this delightful land he ſpreads
his orient beams, on herb, tree, fruit, and flow'r,
gliſtn'ing with dew: fragrant the fertile earth
after ſoft ſhow'rs; and ſweet the coming on
of grateful evening mild: then ſilent night,
with this her ſolemn bird; and this fair moon,
and theſe the gems of heav'n, her ſtarry train.

But neither breath of morn, when ſhe aſcends
with charm of earlieſt birds: nor herb, fruit, flow'r,
gliſt'ning with dew: nor fragrance after ſhow'rs:
nor grateful ev'ning mild: nor ſilent night,
with this her ſolemn bird: nor walk by noon;
or glitt'ring ſtar-light,—WITHOUT THEE *is ſweet.*

MILTON.

SECT. XXVI.

OF VIRTUE.

Virtue, the ſtrength and beauty of the ſoul,
it pleaſes and it laſts:—a *happineſs*
that even above the ſmiles and frowns of fate
exalts great Nature's favourites: a *wealth*
that ne'er encumbers, nor to baſer hands
can be transferr'd: it is the only good
man juſtly boaſts of, or can call *his own.*
Riches are oft by guilt and baſeneſs earn'd;
or dealt by chance, to ſhield a lucky knave,
or throw a fairer ſunſhine on a fool.
But for one end, one much-neglected uſe,
are riches worth your care: (for Nature's wants
are few, and without opulence ſupplied.)
This noble end is, to produce *the ſoul*;
to ſhew the virtues in their faireſt light;
to make humanity the miniſter
of bounteous Providence; and teach the breaſt
that *generous luxury* the good enjoy.
Oh! bleſt of heav'n, whom not the languid ſongs
of luxury, not the inviting bribes
of ſordid wealth, nor all the gaudy ſpoils
of pageant honour can ſeduce to leave
thoſe ever-blooming ſweets, which from the ſtore
of Nature fair imagination culls

to charm th' enliven'd ſoul! *For him,* the ſpring
diſtils her dews, and from the ſilken gem
its lucid leaves unfolds: *for him,* the hand
of Autumn tinges every fertile branch
with blooming gold, and bluſhes like the morn.
Each paſſing hour ſheds tribute from her wings;
and ſtill new beauties meet *his* lonely walk,
and loves unfelt attract him. Not a breeze
flies o'er the meadow, not a cloud imbibes
the ſetting ſun's effulgence, not a ſtrain
from all the tenants of the warbling ſhade
aſcends, but whence *his boſom* can partake
freſh pleaſure, *unreproved.*—Or when lightnings fire
the arch of heav'n, and thunders rock the ground;
when furious whirlwinds rend the howling air,
and ocean, groaning from the loweſt bed,
heaves his tempeſtuous billows to the ſky;
amid the mighty uproar, while below
the nations tremble, he, *good man,* looks abroad,
from ſome high cliff, ſuperior, and *enjoys*
the elemental war.

ARMSTRONG.

SECT. XXVI.

OF HOPE.

THERE ſurely never was a greater number of cures aſcribed to one perſon, than thoſe, which were lately ſaid to have been wrought in FRANCE upon the tomb of Abbé PARIS, the famous JANSENIST, with whoſe ſanctity the people were ſo long deluded. The curing of the ſick, giving hearing to the deaf, and ſight to the blind, were every where talked of as the uſual effects of that holy ſepulchre. But what is more extraordinary; many of the miracles were immediately proved upon the ſpot, before judges of unqueſtioned integrity, atteſted by witneſſes of credit and diſtinction, in a learned age, and on the moſt eminent theatre that is now in the world. Nor is this all: a relation of them was publiſhed and diſperſed every where; nor were the Jeſuits, though a learned body, ſupported by the civil magiſtrate, and determined enemies to thoſe opinions, in whoſe favour the miracles were ſaid to have been wrought, ever able diſtinctly to refute or detect them *.

Where

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* This book was writ by Monſ. MONTGERON, counſellor or judge of the parliament of Paris, a man of figure and character, who was alſo a martyr to

Where ſhall we find ſuch a number of circumſtances, agreeing to the corroboration of one fact? And what have we to oppoſe to ſuch a cloud of witneſſes, but the abſolute

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to the cauſe. There is another book in three volumes (called *Recueil des Miracles de l'Abbé* Paris) giving an account of many of theſe miracles.

Many of the miracles of Abbé Paris were proved immediately by witneſſes before the officiality or biſhop's court at Paris, under the eye of cardinal Noailles, whoſe character for integrity and capacity was never conteſted even by his enemies.

His ſucceſſor in the archbiſhopric was an enemy to the Janſeniſts, and for that reaſon promoted to the ſee by the court. Yet 22 rectors or *cures* of Paris, with infinite earneſtneſs, preſs him to examine thoſe miracles, which they aſſert to be known to the whole world, and indiſputably certain: but he wiſely forbore.

The Moliniſt party had tried to diſcredit theſe miracles in one inſtance, that of Madamoiſelle le Franc. But, beſides that their proceedings were in many reſpects the moſt irregular in the world, particularly in citing only a few of the Janſeniſts' witneſſes, whom they tampered with: beſides this I ſay, they ſoon found themſelves overwhelmed by a cloud of new witneſſes, one hundred and twenty in number, moſt of them perſons of credit and ſubſtance in Paris, who gave oath for the miracle. This was accompanied with a ſolemn and earneſt appeal to the parliament.

All who have been in France about that time have heard of the reputation of Monſ. Heraut, the *lieutenant de Police*, whoſe vigilance, penetration, activity, and extenſive intelligence, have been much talked of. This magiſtrate, who by the nature of his office is almoſt abſolute, was inveſted with full powers, on purpoſe to ſuppreſs or diſcredit theſe miracles; and he frequently ſeized immediately, and examined the witneſſes and ſubjects of them: but never could reach any thing ſatisfactory againſt them.

In the caſe of Madamoiſelle Thibaut he ſent the famous de Sylva to examine her; whoſe evidence is very curious. The phyſician declares, that it was impoſſible ſhe could have been ſo ill as was proved by witneſſes; becauſe it abſolute impoſſibility or miraculous nature of the events, which they relate? And this ſurely, in the eyes of all reaſonable people, will alone be regarded as a *ſufficient refutation.*

The ſiege of BREDA, in the year 1625, affords an

it was impoſſible ſhe could, in ſo ſhort a time, have recovered ſo perfectly as he found her. He reaſoned, like a man of ſenſe, from natural cauſes; but the oppoſite party told him, that the whole was a miracle, and that his evidence was the very beſt proof of it.

No leſs a man than the Duc de CHATILLON, a duke and peer of France, of the higheſt rank and family, gives evidence of a miraculous cure, performed upon a ſervant of his, who had lived ſeveral years in his houſe with a viſible and palpable infirmity.

I ſhall conclude with obſerving, that no clergy are more celebrated for ſtrictneſs of life and manners than the ſecular clergy of France, particularly the rectors or curés of Paris, who bear teſtimony to theſe cures.

The learning, genius, and probity of the gentlemen, and the auſterity of the nuns of Port-royal, have been much celebrated all over Europe. Yet they all give evidence for a miracle, wrought on the niece of the famous PASCAL, whoſe ſanctity of life, as well as extraordinary capacity, is well known. The famous RACINE gives an account of this miracle in his famous hiſtory of Port-royal, and fortifies it with all the proofs, which a multitude of nuns, prieſts, phyſicians, and men of the world, all of them of undoubted credit, could beſtow upon it. Several men of letters, particularly the biſhop of Tournay, thought this miracle ſo certain, as to employ it in the refutation of atheiſts and freethinkers. The queen-regent of France, who was extremely prejudiced againſt the Port-royal, ſent *her own phyſician* to examine the miracle, who returned *an abſolute convert.* In ſhort, the ſupernatural cure was ſo inconteſtable, that it ſaved, for a time, that famous monaſtery from the ruin with which it was threatened by the Jeſuits. Had it been a cheat, it had certainly been detected by ſuch ſagacious and powerful antagoniſts, and muſt have haſtened the ruin of the contrivers.

example almoſt equally ſtriking. "That city, from a long ſiege, ſuffered all the miſeries that fatigue, bad proviſions, and diſtreſs of mind could bring on its inhabitants. Among other misfortunes the *ſcurvy* made its appearance, and carried off great numbers. This, added to the other calamities, induced the garriſon to incline towards a ſurrender of the place, when the Prince of ORANGE, anxious to prevent its loſs, and unable to relieve the garriſon, contrived, however, to introduce letters addreſſed to the men, promiſing them the moſt ſpeedy aſſiſtance. *Theſe were accompanied with medicines againſt the ſcurvy, ſaid to be of great price; but of ſtill greater efficacy, many more were to be ſent there. Three ſmall vials of medicine were given to each phyſician. It was publicly given out, that three or four drops were ſufficient to impart a healing virtue to a gallon of liquor.* We now diſplayed our wonder-working balſams. Nor even were the commanders let into the ſecret of the cheat upon the ſoldiers. They flocked in crouds about us, every one who had the ſcurvy ſoliciting that ſome part might be reſerved for his uſe. Cheerfulneſs again appears in every countenance, and an *univerſal faith* prevails in the ſovereign virtues of the remedies. The effect of this deluſion was truly aſtoniſhing,

ing, *for many were quickly and perfectly recovered. Such as had not moved their limbs for a month before, were ſeen walking the ſtreets with their limbs ſound, ſtraight, and whole.* They boaſted of their cure by the PRINCE's REMEDY, the motion of their joints being reſtored by ſimple friction with oil, and the belly now of itſelf performed its office, or at leaſt with a ſmall aſſiſtance from medicine. Many, who had declared that they had been rendered worſe by all former remedies, recovered *in a few days* to their inexpreſſible joy, and the no leſs general ſurpriſe, by their taking what we affirmed to be their gracious PRINCE's CURE. "*This curious relation,*" adds Dr. LIND *, "*would hardly perhaps gain credit, were it not in every reſpect conſonant to the moſt accurate obſervations, and beſt atteſted deſcriptions of that diſeaſe. It is given us by an eye-witneſs, an author of great candour and veracity, who, as he informs us, wrote down every day the ſtate of his patients, and ſeems more to be ſurpriſed with their unexpected recovery than he probably would have been, had he been better acquainted with the nature of this ſurpriſing malady.* AN IMPORTANT LESSON IN PHYSIC," adds this excellent writer, "IS HENCE TO BE LEARNED, THE WONDERFUL AND POWERFUL INFLUENCE OF

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* LIND on the Scurvy, p. 349.

THE PASSIONS OF THE MIND ON THE STATE AND DISORDERS OF THE BODY. THIS IS TOO OFTEN OVERLOOKED IN THE CURE OF DISORDERS, MANY OF WHICH ARE SOMETIMES ATTEMPTED BY THE SOLE MECHANICAL OPERATION OF DRUGS, WITHOUT CALLING IN TO OUR ASSISTANCE THE STRONG POWERS OF THE IMAGINATION, OR THE CONCURRING INFLUENCES OF THE SOUL. HENCE IT IS, THAT THE SAME REMEDY WILL NOT ALWAYS PRODUCE THE SAME EFFECT, EVEN IN THE SAME PERSON, AND THAT COMMON REMEDIES OFTEN PROVE WONDERFULLY SUCCESSFUL IN THE HANDS OF MEN NOT OF THE FACULTY, WHICH DO NOT ANSWER THE PURPOSE IN A TIMOROUS AND DISTRUSTFUL PATIENT."

SECT. XXVIII.

OF FEAR,

Occaſioning Exertion of Mind.

In chronic diſeaſes, as in hyſteria and hypochondriac patients, in perſons afflicted with aſthma, or with a fit of the gout, tooth-ach, ague, or rheumatiſm, I have known theſe ſeveral diſorders ſuſpended for a time, and often entirely cured, when the mind has been under the influence of fear, ſurpriſe, or rouſed to a fixed attention to ſome intereſting object.

I have frequently obſerved delicate hyſterical women, who, for many months, had ſeldom enjoyed one day's health, ſuddenly relieved from every complaint when a favourite child was attacked with a diſeaſe in which danger was apprehended, and they continued, in appearance, to be in perfect health during the whole courſe of the illneſs, and exhibited an unuſual alertneſs in diſcharging their duty as nurſes and as parents. But when they underſtood that the danger of the diſeaſe was over, their former complaints gradually returned, to their great ſurpriſe; for, from ſo complete a ſuſpenſion of their complaints as they had lately enjoyed, and for ſo conſiderable a time, they believed themſelves perfectly cured.

I have been alſo informed, from the beſt authority, that during the troubles in Scotland, in the years 1745 and 1746, hyſterical and nervous diſorders ſcarcely ever made their appearance.

A very remarkable inſtance of the influence the mind has upon diſorders of the body occurred to the celebrated **Boerhaave.** A perſon fell down in an epileptic fit in the ſight of the other patients. The effect of this operated ſo ſtrongly, that great numbers of them became immediately affected in the ſame manner. The opinion of the great phyſician above mentioned was requeſted on this occaſion. He judiciouſly reflected, that, as theſe fits were originally produced by an impreſſion on the mind, that the moſt proper means of cure would be to eradicate theſe impreſſions by others ſtill more powerful. He therefore directed *actual cauteries* to be prepared, and kept hot, in readineſs to be applied to the perſon who ſhould next be affected. *The conſequence was, not one perſon was ſeized.*

A gentleman of great courage and honour, who had become valetudinary, and ſubject to the aſthma, by long ſervice in India, as an officer in the land forces, told me, he was attacked with a ſevere fit of that diſorder during their encampment, which uſually laſted from ten to twelve days: that, upon the third or fourth day of his illneſs, when he could only breathe in an erect poſture, and without motion, imagining that it was not in his power to move ſix yards to ſave his life, the alarm guns were fired for the whole line to turn out, becauſe a party of the Mahrattas had broke into the camp; and fearing certain death if he remained in his tent, *he ſprung out with an alacrity that amazed his attendants*; *inſtantly mounted his horſe, and drew his ſword with great eaſe, which the day before he could not move from its ſcabbard, though he had uſed his whole ſtrength in the attempt.* From the inſtant of the alarm and ſurpriſe, the *debility* left him, together with the *aſthma*; nor did the diſorder return for ſome time after.

SECT. XXIX.

OF HABIT.

A PROPENSITY to acquire *habits*, and to act from them, when the original incentive has long ſince ceaſed, is a *general law* of the animal œconomy, which though ſometimes the ſource of evil, is in the great tenor of life productive of much good.

The ſavage may faſt many hours and then feed voraciouſly, without ſuffering either by inanition or repletion: but they who, in civilized ſociety, have acquired the *habit* of eating five times every day, cannot paſs one meal, nor without impatience wait five minutes beyond the uſual time of eating. In both, the appetite for food and the powers of digeſtion depend on *habit*.

In caſe of great mental excitement, a man may continue many days without repoſe; but if he has acquired the *habit* of ſleeping at a certain hour, and for a certain length of time, ſleepineſs at that hour will return, and at the *accuſtomed* hours he will awake from ſleep.

Both the deſire for ſleep, and the diſpoſition to awake, may, by *habit*, become as regular as the riſing and the ſetting of the ſun.

The ſame holds good with reſpect to evacuations. I had a nurſe for my children, ſays the ſagacious author of *the Guide to Health*, who was ſo perfectly ſatisfied of this, that ſhe governed them by the clock, and in their earlieſt infancy taught them the vaſt influence of *habit*.

By abſtraction of ſome of the neceſſary ſtimuli, as food, loſs of blood, exhauſting diſeaſes, indolence, and protracted ſleep, the irritable fibres, from being elaſtic and robuſt, and patient of labour, become flaccid, tender, and liable to be ſoon fatigued.

A generous diet, with the aſſiſtance of bark, chalybeates, cold bathing, and ſufficient exerciſe, ſoon however reſtore the *tone* to the fibre. Theſe ſeveral ſtimuli diſtribute, impact, condenſe, and accumulate energy to every part; and bracing up the animated fibre, make it tenacious of vitality.

But when the ſteel, and bark, and bathing, are left off, how is the impulſe to the movements conſtituting health kept up?

Anſ. The actions which theſe occaſioned become aſſociated with the other actions in the frame, and though a link or two in the chain of motions be removed, the circle of motions will neverthelefs proceed for a time in due order *. Thus when a child revolves ſome minutes on one foot, the ſpectra of ambient objects appear to circulate round him ſome time after he falls upon the ground. Thus the ſtomach feels ſqueamiſh, and the objects dance about, to thoſe who are juſt come on ſhore after a long voyage. Thus the palpitation of the heart continues ſome time after the object of fear which occaſioned it is removed. And thus the bluſh of ſhame, which is an exceſs of ſenſation, and the glow of anger, which is an exceſs of volition, continue ſome time, though the affected perſon finds, that thoſe emotions were cauſed by miſtaken facts, and even endeavours to extinguiſh their appearance.

Beſides, during this interval of increaſed action, the diſeaſe is baffled, and the fibre is invigorated, and the conſtitution being ſet to rights, naturally continues to go on well by means of the natural ſtimuli, which are ſufficient for the purpoſes of the animal economy in a ſtate of health.

Every part of the ſyſtem is, as we have ſeen, under the influence of *habit*, and even the *mind* itſelf is not exempt from it.

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* Dr. Darwin.

Some aſſociated motions are governed by the will, as in playing the violin or flute, and the arts of turning, ſpinning, and of weaving.

Motions are eaſily aſſociated, if they ſerve the purpoſes of life; but not if they go counter to natural combinations, as when the ſilver-ſmith, for the firſt time, attempts to inſpire by his noſtrils whilſt he is blowing through his lips. Yet by frequent repetition the *habit* is obtained, and the conſent of parts is effectually eſtabliſhed. One combination, however, is ſo perfectly unnatural, that no one has yet been able to deſcribe at the ſame time two circles in oppoſite directions, one with his foot, the other with his hand.

Some aſſociated motions, although at firſt either voluntary or accidental, become at laſt wholly independent of volition. Thus it is, that by *habit* we acquire tricks.

Other aſſociated motions are from the beginning independent of the will, ſuch as the vital motions, and thoſe which are eſtabliſhed by diſeaſe.

The generous ſteed, once ſet in motion, no longer needs the whip and ſpur, nor yet the curb, unleſs it be to make a change, and either to quicken or retard his motions. And the rider himſelf, if he has been *accuſtomed* to travel on one road, may wholly occupy his mind about a thouſand ſpeculations, or with intenſity of thought, purſue one continued ſeries of ideas; and yet, although he may often change his direction, never wander from his way.

All animals have their haunts and home-buſh. Their firſt object of purſuit is *food*, and with regard to this they have all their haunts.

The ſportſman knows where to look for the covey of partridges to-day, which yeſterday he moved, whilſt they were feeding in the ſtubble; and we have every reaſon to believe, that even birds of paſſage return annually to their accuſtomed ſpot.

The next object of purſuit to animals is ſome *ſafe retreat*, in which they may quietly repoſe, ſome hiding-place, in which to ſleep. In the choice of a ſequeſtered ſpot, it is probably accident which firſt determines them; but the choice once made, they *habitually* return to it, unleſs fear, or ſome motive more powerful than habit, determines them to change it.

When they are to paſs from their place of reſt in ſearch of food, the choice of a path is not a matter of indifference, but it is influenced by *habit*. If one of the ſame ſpecies has paſſed before them, they follow in his ſteps, and having once paſſed unmoleſted in this path, they tenaciouſly adhere to it.

Hares have their track, with which the poacher is well acquainted, for it is here he fixes up his ſnare. Sheep and horſes have each their peculiar track; and it is well known that men will tread where men have trod before, inſomuch that if a drunken clown makes a crooked path over a new ploughed field, the next who follows will inadvertently trace his footſteps; and, having once paſſed by a given track, men habitually reſort to it again.

I have frequently remarked the force of *habit* in large companies, who dine together at a public table, for every man, even without intending it, returns to the ſame ſeat he occupied the day before.

And in a farmer's ſtable, or in his ſhed, his horſes and his cows pertinaciouſly retain each one its peculiar place; and ſhould it be occupied by ſome impertinent intruder, this will be a ſufficient ſubject of contention.

In their friendſhips animals are governed by the force of *habit*, for any two which meet accidentally, at a time and place diſtant from each other, and ſuppoſing them not to be reſtrained by ſome more powerful influence, will immediately become aſſociates.

If two horſes, ſtrangers to each other, travel together to a fair, although they ſhould have formed an acquaintance only for ten minutes, they will find each other out among a thouſand others, and will quickly come together.

Hence it is, that nature learns in a meaſure to provide for *habitual* drains, and uſually feels burthened if theſe are intermitted. This obſervation extends to hæmorrhages, whether artificial, natural, or morbid; to perſpiration; to ulcers; to iſſues; and in ſhort to every other drain, as the expectoration of mucus, &c.

The *habits* acquired by the conſtitution depend on ſuch nice circumſtances, that when *one kind* of ſtimulus *ceaſes* to rouſe the excitability into the neceſſary quantity of exertion, it is often ſufficient to produce the deſired effect, to *change* the ſtimulus for another *apparently* ſimilar in quantity and quality.

An agreeable illuſtration of this is given us by the learned and elegant Dr. DARWIN. A little boy, who was tired with walking, begged of his papa to carry him. "*Here*," ſays the reverend divine, "*ride on my gold-headed cane*;" and the pleaſed child, putting it between his legs, galloped away with delight, and complained no more of his fatigue.

Here the aid of another excitement, that of *pleaſureable ſenſation*, ſuperadded vigour to the exertion of *exhauſted volition*; which could otherwiſe only have been excited by *additional pain*, as by the laſh of ſlavery. Thus a perſon, who has dined fully, or is either fatigued in body, or tired with intellectual exertion, and therefore under a great diſpoſition to ſleep, will be recruited by *coffee*; and when the laſt fails, the more diffuſive ſtimulus of *opium* will arouſe him. Even after opium fails, and he is left heavy and oppreſſed by the ſame propenſity to ſleep, the tiding of ſome unforeſeen *accident*, demanding his inſtant attention, will remove this inclination for a time.

A gentleman engaged in a literary compoſition, which required uninterrupted exertion of his mental faculties for more than 40 hours, was enabled to go through it by ſupporting himſelf in this manner. After dinner, commencing his buſineſs, he took *a glaſs of wine* every hour. Ten hours after he ate ſomething *nouriſhing*, but ſparing in quantity, and for ſome time kept his attention alive by means of *punch* not made too ſtrong. When, however, he found himſelf at laſt nigh to be overcome by ſleep, he changed this ſtimuli for an *opiate*, and finiſhed his buſineſs in 40 hours. He then took *a glaſs of wine*, and *converſed* five hours with his employer. The *ſucceſſion* of ſtimuli in this caſe was firſt *food*, next the ſtimulus of *mental exertion*, then *wine*, then *food* varied, then *punch*, then *opium*, then *wine* again, and laſtly *pleaſureable converſation*.

Some years after that, ſays Dr. BROWN, I walked and wandered in all ſorts of ground, in roads and out of them, over ſmooth and plain, and heathy and mountainous tracts, from four o'clock after mid-day to two o'clock the next day, with only an hour's reſt, and one hearty meal at betwixt ten and eleven in the forenoon, when I was now within ſix miles of my deſtination. The hills over which I wandered in the courſe of the night are thoſe called Lammer-Muir, ſituated betwixt Eaſt-Lothian and the Mers: the places I travelled between in this route were Edinburgh and Duns. In this great exertion I was ſuſtained by different ſtimuli, which made me inſenſible to fatigue, the *ſucceſſion of objects*, high *animal ſpirits*, and *love*. At the end of my long journey, finding myſelf among my friends, and the object of my affection, I had ſtrength enough ſtill remaining *to dance* with the latter.

The ſame may be obſerved with regard to medicines, when we wiſh to *increaſe* the tonic power of any ſtimulus we ſhould *change* it, and thus *ſubſtitute* bitters for bark, and then recur again to bark or ſteel. Thus when wine ceaſes ſufficiently to ſtimulate the conſtitution, opium or æther, in appropriate doſes, ſupplies the defect; and the contrary. This is alſo obſerved in the effects of cathartic medicines, for when one loſes its power, another apparently leſs efficacious will ſucceed.

An EXCEPTION *to this Influence of Habit.*

When the *firſt impreſſion*, however, is *very ſtrong*, and the *effect* produced *very violent*, a force or power *inferior* to the original one will produce the *ſame effect*.

Thus it has often been remarked, that if a perſon, unaccuſtomed to the uſe of purgatives, was to take at a doſe 20 grains of aloes, the ſmartneſs of the operation would leave ſuch a laſting impreſſion, that an equal effect would afterwards be produced by one half, one fourth, or even one tenth, of the ſame quantity; whereas, had the original doſe been only a grain and a half, it might have been neceſſary to increaſe it to ten or fifteen grains, to produce any the leaſt effect.

To explain this curious and perplexing phænomenon, we muſt remind the reader, that the chain of aſſociated actions when weak, being broken, the conſtitution is eaſily diſturbed. Thus when a perſon is beginning to learn the alphabet, or the multiplication table, the ideas firſt get aſſociated in the order of the table; but ſhould the young ſcholar ſkip over three or four ſteps, his recovery would be then impracticable. And, again, perſons, by a ſtrong emetic, have had their ſtomach rendered ſo irritable, that afterwards one twentieth of the firſt doſe has proved a ſufficient emetic. It is thus alſo that a ſudden and ſtrong terror makes a coward for life; and fits that have been brought on by fright, recur when even a leſs occaſional cauſe ſhould chance to preſent itſelf.

A black ſervant in the country, on going to his pantry in the hall, was ſuddenly ſhot at by a robber who lay lurking behind a ſcreen. The family being alarmed, found the ſervant to all appearance dead. He paſſed nearly the whole night in fits, and ever after, whenever it thundered much, or he was ſurpriſed by a flaſh of lightning, he was ſure to be thrown into fits.

In ſuch caſes perhaps the *fibre* is weakened, and the *conſtitution* or *temperament* is entirely changed; but of this more will be ſaid when we come to treat on the Nature of Diſeaſe.

END OF THE SECOND VOLUME.